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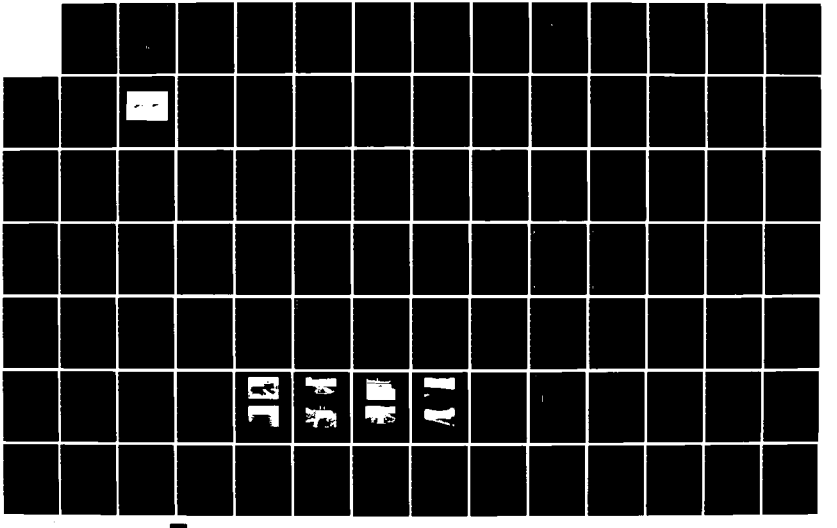

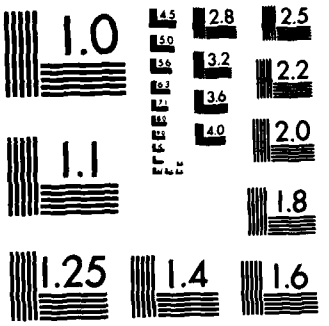

CONNECTICUT RIVER BASIN
WEST HARTFORD, CONNECTICUT

BUGBEE RESERVOIR DAM
CT 00491

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JUNE 1981

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,
Connecticut River Basin
West Hartford, Connecticut

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Bugbee Reservoir Dam consists of an earth embankment, approximately 410 ft. long with a top width of 14 ft. and a maximum height of 20 ft. Based on the visual inspection and review of available plans and reports, Bugbee Reservoir Dam is judged to be in good condition; however, during the inspection, there was a light snow cover of two to three inches which may have obscured problems such as erosion or settlement. The dam is classified as 'Intermediate' in size with 'High' hazard potential. A test flood equal to the PMF was selected.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:

JUL 09 1981

NEDED

Honorable William A. O'Neill
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor O'Neill:

Inclosed is a copy of the Bugbee Reservoir Dam (CT-00491) Phase I Inspection Report, prepared under the National Program for Inspection of Non-Federal Dams. This report is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. I approve the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is vitally important.

Copies of this report have been forwarded to the Department of Environmental Protection.

I wish to thank you and the Department of Environmental Protection for your cooperation in this program.

Sincerely,

C. E. EDGAR, III
Colonel, Corps of Engineers
Commander and Division Engineer

Incl
As stated

BUGBEE RESERVOIR DAM

CT 00491

CONNECTICUT RIVER BASIN

WEST HARTFORD, CONNECTICUT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

IDENTIFICATION NO: CT-00491

NAME OF DAM: Bugbee Reservoir Dam

TOWN: West Hartford

COUNTY AND STATE: Hartford County, Connecticut

STREAM: Hart Meadow Brook

DATE OF INSPECTION: December 16, 1980

BRIEF ASSESSMENT

Bugbee Reservoir Dam consists of an earth embankment, approximately 410 ft. long with a top width of 14 ft. and a maximum height of 20 ft. The low level outlet for the project is the principal spillway which consists of a two-stage reinforced concrete intake riser, a 48-inch reinforced concrete pipe and a 21 ft. long concrete impact basin. In addition to the low level outlet, there is a 200 ft. wide, grassed trapezoidal channel at the dam's south end serving as the emergency spillway.

Based on the visual inspection and review of available plans and reports, Bugbee Reservoir Dam is judged to be in good condition; however, during the inspection, there was a light snow cover of two to three inches which may have obscured problems such as erosion or settlement. In addition, since the reservoir area was dry, the inspection could not reveal seepage conditions.

As per the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, the Bugbee Reservoir Dam is classified as 'Intermediate' in size with 'High' hazard potential. A test flood equal to the probable maximum flood (PMF) was selected in accordance with the Corps of Engineers' Guidelines. The calculated test flood inflow of 4000 cfs which includes 1680 cfs overflow from Talcott Reservoir, results in a routed outflow of 3400 cfs. With the water level at the top of the dam the maximum spillway capacity is 6000 cfs, which is 175% of the routed test flood outflow. The storage capacity of the reseroir at the top of the dam is 1300 ac. ft.

As the dam is a 'high' hazard potential, and a breach may result in excessive economic loss and more than a few lives may be endangered, an emergency operation plan should be prepared and implemented. An operation and maintenance manual describing normal routine procedures should also be prepared.

It is recommended that the owner employ a qualified registered engineer to do the following within two years of receipt of this report:

Inspect the dam during the time that water is impounded in the reservoir with particular attention to locating possible seepage;

Inspect the dam at a time when there is no snow cover with particular attention to locating areas of erosion and settlement, and animal burrows.

In addition to these recommendations there are also several remedial measures contained in Section 7 which should be carried out by the owner within two years of receipt of this report.

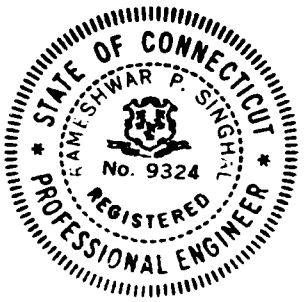
GOODKIND & O'DEA, INC.
AND
SINGHAL ASSOCIATES
(J.V.)

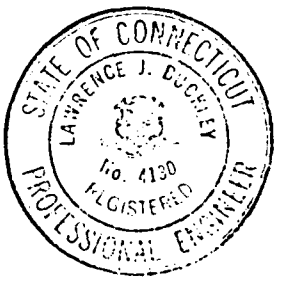
Ramesh P. Singhal

Ramesh Singhal, PH.D., P.E.
(Singhal Associates)

Lawrence J. Buckley

Lawrence J. Buckley, P.E.
(Goodkind & O'Dea, Inc.)





This Phase I Inspection Report on Bugbee Reservoir Dam (CT-00491) has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

JOSEPH W. FINEGAN, JR., CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the

present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there by any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the pulic. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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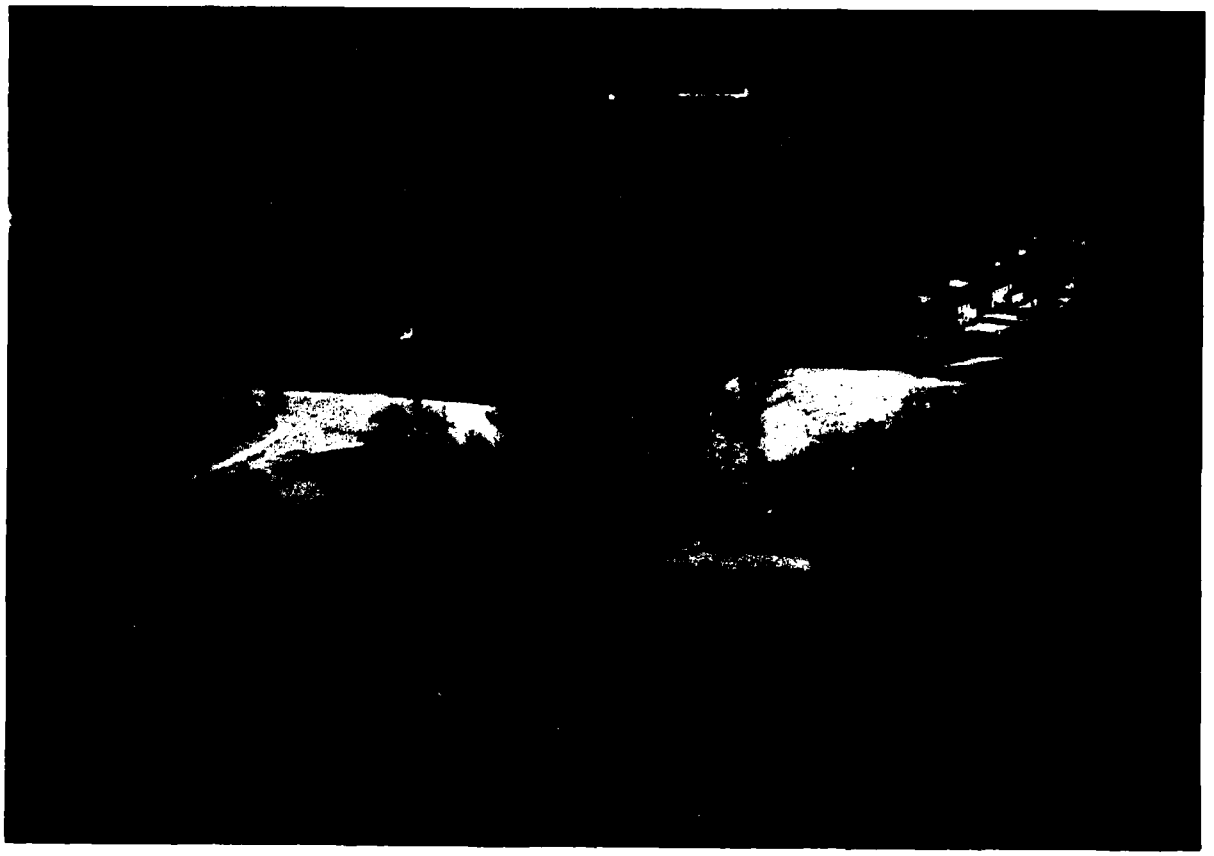
APPENDICES



NOTES:

1.) VIEW OF DAM LOOKING DOWNSTREAM

2.) OVERVIEW PHOTO TAKEN DECEMBER 20, 1980.

GOODKIND & O'DEA INC—SINGHAL ASSOCIATES(J.V.) ENGINEERS	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

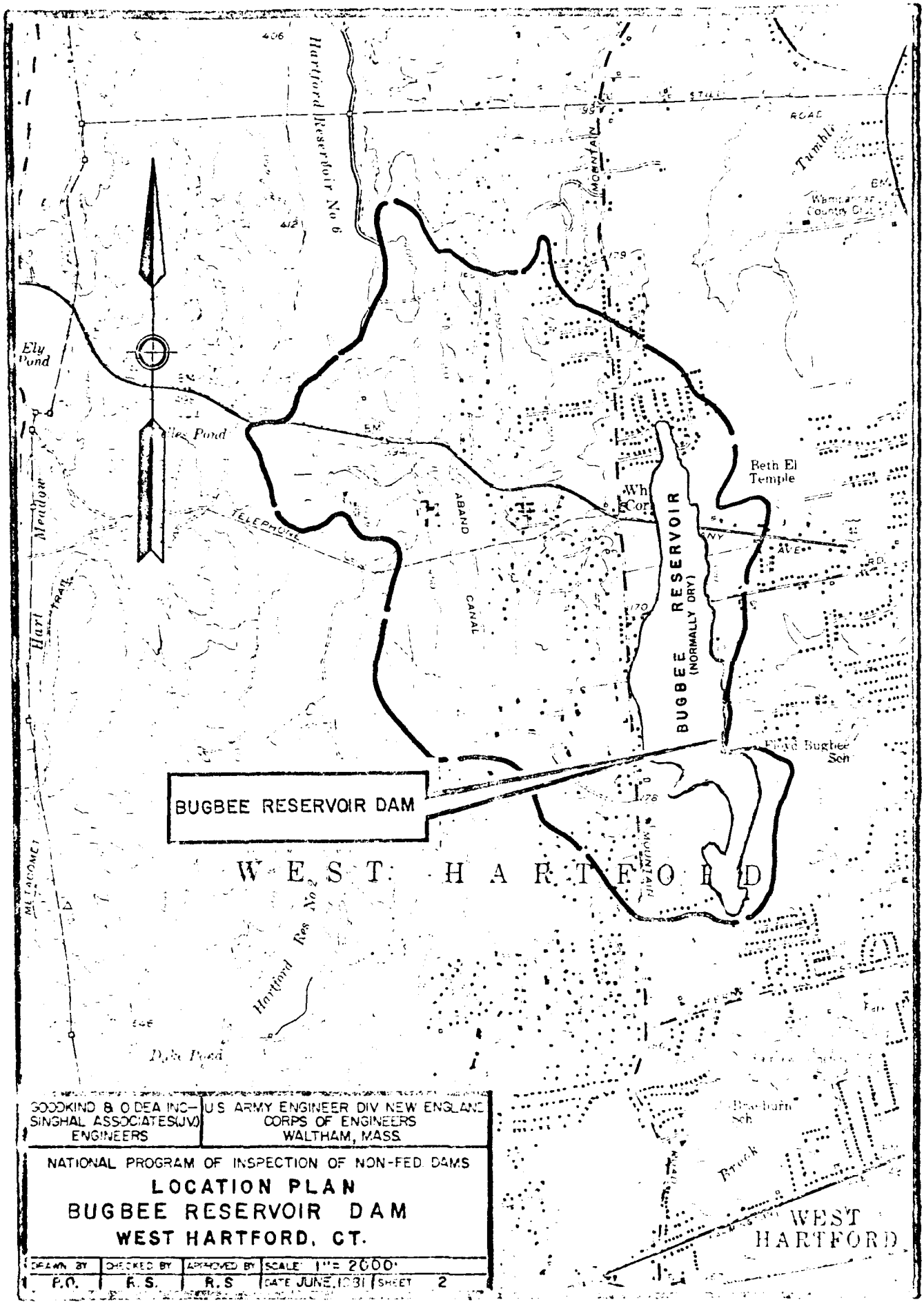
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

OVERVIEW PHOTO OF DAM

BUGBEE RESERVOIR DAM

WEST HARTFORD, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE NONE	
E.T.K	W.J.W	L.J.B	DATE JUNE, 1981	SHEET 1



GOODKIND & O'DEA INC–SINGHAL ASSOCIATES(JV) ENGINEERS	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION PLAN
BUGBEE RESERVOIR DAM
WEST HARTFORD, CT.

DRAWN BY	CHECKED BY	APPROVED BY	SCALE	SHEET
P.O.	R.S.	R.S	1"=2000'	2

DATE JUNE, 1981

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

PROJECT INFORMATION
Section I

1.1 GENERAL

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Goodkind & O'Dea Inc., Hamden, Conn. and Singhal Associates, Orange, Connecticut (Joint Venture) have been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to Goodkind & O'Dea Inc. and Singhal Associates (J.V.) under a letter of December 9, 1980 from Colonel William E. Hodgson, Jr., Corps of Engineers. Contract No. DACW 33-81-C-0022 dated December 9, 1980 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interest.

2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.

3. To update, verify and complete the National Inventory of Dams.

1.2 DESCRIPTION OF PROJECT

a. Location

Bugbee Reservoir Dam is situated on the Hart Meadow Brook, a tributary of Trout Brook in the watershed of South Branch of Park River. The confluence with the Park River is approximately 5½ miles downstream. Location of the project is approximately 2.2 miles northeast of West Hartford Town Hall and 0.7 miles east of the intersection of Haynes Road and North Main Street. The geographic location of the site may be found on the Avon Quadrangle Map, having coordinates of latitude N41°-46.8' and longitude W72°-45.7'.

b. Description of Dam and Appurtenant Structures

Bugbee Reservoir is impounded by Bugbee Reservoir Dam which is a grass-covered, homogeneous earth embankment, 410 ft. long. Excavated material from the emergency spillway consisting of a poorly graded non-plastic fine sand was utilized in the dam embankment. Top width of the dam is 14 ft. whereas the upstream and downstream slopes are 3 1/2 horizontal to 1 vertical and 3 horizontal to 1 vertical respectively. Bugbee dam has a top elevation of 167.8' (MDC Datum-Metropolitan District Commission Datum - 2.08' higher than NGVD) and a maximum height of 20 ft. Extending to the hardpan a cutoff trench, 8 ft. wide and varying from approximately 2 to 5 ft. deep is centered under the dam crest. In addition, there is a 3 ft. wide foundation drain trench located under the downstream slope as noted on the general dam plan in Appendix B. The underdrain system

outlets into the concrete impact basin through two 6" perforated pipes. Under the dam's north end, there is also an 18" sewer pipe encased in concrete as shown on the general dam plan in Appendix B.

Serving as the low level outlet, the principal spillway consists of a two-stage reinforced concrete intake riser discharging through a 48-inch reinforced concrete pipe under the dam embankment. The pipe is 112 ft. long and discharges into a 21 ft. long concrete impact basin leading to the natural downstream channel. The low level inlet of the intake riser is a 1 ft. high by 9 ft. wide rectangular opening with an invert elevation of 147.5' (MDC Datum) whereas the high level inlet weirs are at an elevation of 152.0' (MDC Datum). Trash racks are located at both the low level inlet and the high level inlet weirs on the intake riser.

The emergency spillway is a grassed trapezoidal channel 200 ft. wide at the control section with a crest elevation of 163.3' (MDC Datum) which is 4.5 ft. below the crest of the dam. As shown on the general dam plan in Appendix B, the side slopes of the emergency spillway approach and discharge channels are 3 horizontal to 1 vertical. The approach channel bottom is level whereas the discharge channel is at a grade of 2.25%. Situated on the north side of the discharge channel is an earthfill dike with a crest 14 ft. wide and at the same elevation as the top of dam. The dike has side slopes of 3 horizontal to 1 vertical with rip-rapping along the south slope (See typical section of emergency spillway, Sheet B-2).

c. Size Classification: 'Intermediate'

According to the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, a dam is classified 'Intermediate' if either its height is between 40 and 100 ft. or the storage volume is between 1000 and 50,000 ac. ft. The Bugbee Reservoir Dam has a maximum height of only 20' but the maximum storage is 1300 ac. ft. As such, it is classified as 'Intermediate in size.

d. Based on the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, the hazard classification for Bugbee Reservoir Dam is 'high'. A dam failure analysis indicates that a breach of the dam would result in a downstream flood flow of approximately 20,000 cfs causing an 11 ft. high wave of water to travel down the Hart Meadow Brook and its overbanks on both sides. Continuation of the valley flood routing through Hart Meadow Brook shows that even at the 3rd cross-section located 5,000 ft. down from the dam near Brookside Drive, the excess flow and wave heights are as high as 16,000 cfs and 10 ft. respectively.

The depths of flow in the brook in the area of the 15 houses considered (the last one being 2,700 ft. from the dam) are 4 ft. at pre-failure depth and 11 ft. at post failure depth. None of these houses which are located on Asylum Avenue, Fox Chase Lane, Pioneer Drive and Harvest Lane are subject to flooding under the test flood conditions. Under dam failure conditions, they will be flooded to depths of 1 ft. to 3 ft. above their first floor elevations.

The dam failure would result in flooding of a number of houses and streets including State Route 4 (Asylum Avenue). There is potential for 'excessive economic loss' and possible loss of more than a few lives.

e. Ownership

The Bugbee Reservoir and Dam are owned by:

The State of Connecticut
Department of Environmental Protection
State Office Building
165 Capitol Avenue
Hartford, Conn. 06115
Telephone: (203) 566-7244/7245

f. Operator

Mr. Victor Galgowski
Superintendent, Dam Maintenance
D.E.P. (Water Resources Unit)
165 Capitol Avenue
Hartford, Conn. 06115
Telephone: (203) 566-7244/7245

g. Purpose of Dam

The purpose of the dam is flood control.

h. Design and Construction History

The dam and appurtenant structures were designed in the year 1965 by the U.S. Department of Agriculture, Soil Conservation Service in Storrs, Connecticut. In 1969 the dam construction was completed.

i. Normal Operational Procedures

The Bugbee Reservoir is normally dry with no permanent pool. At this time, there are no operational procedures, such as dam surveillance or reservoir level readings.

1.3 PERTINENT DATA

a. Drainage Area

The drainage area consists of 1.86 sq. mi. of moderately sloping terrain, with an average slope of approximately 4.5% and elevations ranging from 160 to 700' MSL. Most of the area is inhabited and has a number of town roads passing through it. In addition to the runoff from this drainage area, the project receives 1680 cfs overflow from Talcott Reservoir.

b. Discharge at Damsite

Discharge from the impoundment occurs at two spillway facilities. The principal spillway is a drop inlet structure consisting of a two-stage reinforced concrete intake riser and a 112 ft. long 48" reinforced concrete pipe under the dam embankment. The emergency spillway is a trapezoidal grassed channel 200 ft. wide at the control section and located at the south end of the dam.

1.	Outlet works (conduits) size:	1-48" RCP
	Low level inlet invert elevation:	147.5' (MDC Datum)
	High level weir inlet elevation:	152.0' (MDC Datum)
	Discharge capacity at test flood:	250 cfs
	Elevation:	166.3' (MDC Datum)
2.	Maximum known flood at damsite:	Unknown

	Principal Spillway (cfs)	Emergency Spillway (cfs)	Total (cfs)
3. Ungated spillway capacity at top of dam:	270	5700	6000
Elevation:			167.8' (MDC Datum)
4. Ungated spillway capacity at test flood elevation:	260	3140	3400
Elevation:			166.3' (MDC Datum)
5. Gated spillway capacity at normal pool elevation:			N/A
6. Gated spillway capacity at test flood elevation:			N/A
7. Total spillway capacity at test flood elevation:	260	3140	3400
Elevation:			166.3' (MDC Datum)

8. Total project discharge at
   top of dam: 6,000 cfs
   Elevation: 167.8' (MDC Datum)

9. Total project discharge at
   Test flood elevation: 3,400 cfs
   Elevation: 166.3' (MDC Datum)

c. Elevation - Feet above MDC Datum (2.08 higher than the NGVD)

1. Streambed at toe of dam: 147.2

2. Bottom of cutoff: Varies

3. Maximum tailwater: N/A

4. Recreation pool: N/A

5. Full flood control pool: 163.3

6.	Spillway crest:	163.3 (Emergency) 152.0 (Principal - high level inlet weir)
7.	Design surcharge - original design:	165.75
8.	Top of dam:	167.8
9.	Test flood surcharge:	166.3

d. Reservoir - Length in Feet

1.	Normal pool:	N/A
2.	Flood control pool:	6,750
3.	Spillway crest pool: Emergency spillway Principal spillway (High level inlet weir)	 6,750 400
4.	Top of dam:	7,400
5.	Test flood pool:	7,150

e. Storage - Acre Feet

1.	Normal pool:	N/A
2.	Flood control pool:	730
3.	Spillway crest pool: Emergency spillway Principal spillway (High level inlet weir)	 730 6
4.	Top of dam:	1,300
5.	Test flood pool:	1,100

f. Reservoir Surface - Acres

1.	Normal pool:	N/A
2.	Flood control pool:	120.0

3. Spillway crest pool:

Emergency spillway	120.0 Acres
Principal spillway (High level inlet weir)	2.0 Acres

4. Top of dam: 157.0 Acres

5. Test flood pool: 132.5 Acres

g. Dam

1.	Type:	Earth Embankment
2.	Length:	410 ft.
3.	Height:	20 ft.
4.	Top width:	14 ft.
5.	Side slopes:	3½ hor. to 1 vert. (upstream) 3 hor. to 1 vert. (downstream)
6.	Zoning:	None. The entire embankment consists of homogeneous fill.
7.	Impervious core:	N/A
8.	Cutoff:	There is a cutoff trench with depth varying from 2 to 5 ft. and bottom width 8.0 ft.
9.	Grout curtain:	N/A
10.	Other:	There is a 3 ft. wide foundation trench under the downstream slope with 2-6" perforated pipe outlets at the impact basin.

h. Diversion and Regulating Tunnel N/A

i. Spillway

	Principal Spillway	Emergency Spillway
1. Type	Drop inlet structure consisting of a two-stage reinforced concrete intake riser with a 48" reinforced concrete pipe.	Grassed trapezoidal channel
2. Length of crest:	16 ft. (high level inlet weir)	200 ft. at the control section
3. Crest elevation (MDC Datum)		
w/flashboards	N/A	N/A
w/o flashboards	152.0' (MDC Datum) (high level inlet weir)	163.3' (MDC Datum)
4. Gates	N/A	N/A
5. Upstream channel	Natural channel	N/A
6. Downstream channel	21' long impact basin leading to the natural channel	N/A
7. General	N/A	N/A

j. Regulating Outlets

The only outlet is the unregulated principal spillway (See section 1-3-i).

ENGINEERING DATA
Section 2

2.1 Design Data

A comprehensive design report prepared in 1965 by United States Department of Agriculture, Soil Conservation Service and entitled "South Branch Park River Watershed Protection Project, Design Report, Dam No. 2, Bugbee Reservoir, Hartford County, Connecticut" is available. The design report includes hydrologic and hydraulic data and computations, geology report, soil testing report, and dam stability analysis. Several pages of the report, pertaining to the original design data of the dam have been copied and are included in Appendix B.

2.2 Construction Data

"As-Built" drawings entitled "South Branch Park River Watershed Project, Floodwater Retarding Dam No. 2 Bugbee Reservoir" are available. These drawings have been reviewed and found to show good agreement with the visual inspection. Certain details have been copied from the "As-Built" drawings provided by the U.S. Department of Agriculture, Soil Conservation Service in Storrs, Connecticut and are included in Appendix B.

2.3 Operational Data

Normally a pool does not exist and water level readings are not taken during flood impoundments. According to the owner, water levels have never risen to the level of the emergency spillway crest. No formal operation records are known to exist.

2.4 Evaluation

a. Availability

Available existing data was provided by the State of Connecticut Department of Environmental Protection who are owners and the U.S. Soil Conservation Service who designed and constructed the dam. Location of the available data is given in Appendix B.

b. Adequacy

The engineering data available, when coupled with visual inspection, were generally adequate to perform an assessment of the dam.

c. Validity

A comparison of record data and visual observations reveals no significant discrepancies in the record data.

VISUAL INSPECTION
Section 3

3.1 Findings

a. General

On December 16, 1980, engineers from Goodkind & O'Dea, Inc., performed a formal field inspection of Bugbee Reservoir Dam. Detailed checklists included in Appendix A were utilized for the inspection of the dam and spillways. Photographs showing these dam features were also taken during the inspection and are given in Appendix C along with photo location plan.

The general condition of the project is good; however, there are some areas requiring minor maintenance and/or monitoring. At the time of the inspection, the reservoir area was dry and two to three inches of light snow covered the ground. The snow may have obscured problems, such as erosion, settlement or rutting.

b. Dam

The dam is a grass covered, earthfill embankment with a foundation drain trench underlying the downstream slope. As shown in Photos 1 and 2, the alignment appeared good with no signs of vertical or horizontal movement. There was no evidence of any erosion on the dam embankment which was covered with a two to three inch layer of snow. Minor rutting was observed along the crest of the dam indicating some vehicular trespassing.

No evidence of any downstream embankment seepage was observed; however, since the reservoir area was dry, no conclusive determination could be made. The foundation underdrain system discharges into the mesh-covered impact basin which prevents close inspection of the two drain outlets. Observations made from the top of the impact basin indicated the outlets to be clean and dry.

c. Appurtenant Structures

Principal Spillway

The principal spillway consists of a two stage reinforced concrete intake riser with a 48" reinforced concrete pipe and a reinforced concrete impact basin. Impounded storm-water runoff and the normal brook flow passes through the dam embankment in these structures. The general condition of the structures was very good with no evidence of any concrete cracking or spalling (See Photos 4 & 5). Located at both the high level and low level inlets of the intake riser, the metal trash racks were well painted and structurally sound. The metal safety mesh cover on top of the impact basin was moderately rusted and showed signs of minor deterioration. Observations revealed a small pile of rip-rap in front of the trash rack at the low level inlet of the intake riser partially obstructing the brook flow. The channel upstream from the riser was clean and in good condition as shown in Photo 3.

Emergency Spillway

Located at the south end of the dam, the emergency spillway which was covered with a two to three inch layer of snow appeared to be in good condition (See Photos 7 & 8). There was no evidence of any vehicular trespassing or erosion along the channel floor or slopes. The earthfill dike situated on the north side of the spillway appeared stable as was the rip-rapped slope along the south face of the dike.

d. Reservoir Area

Primarily consisting of wetlands and wooded areas,

the reservoir area contains no structures or recreational facilities; however, a series of hiking trails have been planned and will be built within the reservoir at some unknown date. Numerous residential homes border the reservoir area which was dry at the time of the inspection.

e. Downstream Channel

The channel downstream from the principal spillway is rocky and generally in very good condition as shown by Photo 6. Minor brush growth was noted along the channel slopes which appeared to be stable. The rip-rapped area just downstream from the impact basin was also stable with no evidence of failure.

3.2 Evaluation

Based upon the visual inspection, the general condition of the dam and spillways was good; however, the snow cover may have obscured problems, such as erosion, settlement or rutting.

Since the dam is a flood control project and the reservoir is normally dry, the inspection could not reveal seepage conditions. Thus, this inspection could not evaluate the seepage conditions that may exist when water is impounded in the reservoir.

OPERATIONAL AND MAINTENANCE PROCEDURES
Section 4

4.1 Operational Procedures

a. General

At this time there are no operational procedures such as dam surveillance or reservoir level readings. The spillways were designed to be uncontrolled and, therefore, would not have any operational procedures.

b. Description of any Warning System in Effect

There are no warning systems in effect.

4.2 Maintenance Procedures

a. General

The Town of West Hartford leases the Bugbee Reservoir area from the State of Connecticut Department of Environmental Protection and is responsible for general maintenance. A copy of the lease is available from the State of Connecticut Department of Environmental Protection, or the Town of West Hartford.

The dam embankment, emergency spillway and portions of the reservoir area are mowed biannually by the Town of West Hartford. In addition, the upstream and downstream channels are generally cleaned and cleared of debris and brush annually.

Representatives from the State of Connecticut Department of Environmental Protection and the U.S. Soil Conservation Service inspect Bugbee Reservoir Dam yearly. The general condition of the dam and appurtenant structures are evaluated during this inspection and recommendations for repairs and/or maintenance are made. A copy of the latest inspection report is included in Appendix B.

b. Operating Facilities

Although the Town of West Hartford leases the reservoir area, the State of Connecticut Department of Environmental Protection has responsibility for the construction, operation, and structural repair of the flood control works.

4.3 Evaluation

The operational and maintenance procedures are generally satisfactory but there are areas requiring improvement. A formal operational procedure with records of maximum pool levels during flood impoundments and a downstream emergency warning plan should be developed by the State of Connecticut Department of Environmental Protection. In addition, formal maintenance procedures with records should also be developed by the State of Connecticut Department of Environmental Protection with the Town of West Hartford to insure the continued safety of the dam. A list of recommended procedures for the operation and maintenance of the dam is given in Section 7.

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES
SECTION 5

5.1 GENERAL

Bugbee Reservoir was created in the late 1960's to reduce potential flooding in the watershed area of South Branch of Park River. Detailed designs were prepared by the U.S. Department of Agriculture, Soil Conservation Service.

The Reservoir has a contributory drainage area of 1.86 square miles which is moderately sloping with average slope of approximately 4.5%. A good part of this area is developed and has several town roads over it along with many houses and other buildings.

There is a 48-inch outlet pipe under the dam and a two-stage reinforced concrete intake riser upstream of the dam acting as the principal spillway,and a trapezoidal grassed channel, 200 ft. wide at the control section which serves as the emergency spillway. With the pool level at the dam crest the combined spillway capacity is 6,000 cfs, whereas, at the test flood elevation 166.3' (MDC Datum) the capacity is 3,400 cfs. The crest elevation of the dam is 167.8' (MDC Datum) which is 4.5 ft. higher than the emergency spillway crest elevation of 163.3' (MDC Datum).

5.2 Design Data

Detailed plans, the as-built drawings and the design reports are available at the U.S. Department of Agriculture, Soil Conservation Service in Storrs, Connecticut. Required

design data are contained therein.

The design test flood inflow for Bugbee Reservoir Dam was 6,750 cfs and the routed outflow was 1,880 cfs, with the design highwater elevation in the reservoir computed to be 167.75' (MDC Datum), giving a freeboard of 2.05 ft.

5.3 Experience Data

No records are kept of reservoir levels during the times that water is impounded at Bugbee Dam.

5.4 Test Flood Analysis

Based on the dam failure analysis, the Bugbee Reservoir Dam is classified as being 'high' hazard potential in accordance with the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams. The test flood should be equal to the probable maximum flood (PMF) which was accordingly adopted for analysis.

An inflow peak rate of runoff was calculated for 1.86 square miles of watershed area. The terrain was judged to have average slopes somewhat more severe than represented by the "Flat and Coastal' category. A runoff factor of 1250 cfs per square miles was accordingly adopted resulting in a runoff equal to 2,325 cfs. An overflow of 1,680 cfs from Talcott Reservoir was added to the runoff increasing the Bugbee Reservoir test flood to approximately 4,000 cfs.

A triangular hydrograph was constructed using the methodology given in the 'Hydrology, Section 4, SCS National Engineering Handbook'. The peak inflow rate of 2,325 cfs and a total

runoff of 19.0 inches for the PMF were used to construct the inflow hydrograph.

Flood routing through the reservoir was assumed with an initial water elevation of 163.3' (MDC Datum) which was at the crest of the emergency spillway control section. The test flood produced a maximum discharge of 3,400 cfs which is considerably less than the spillway capacity of 6,000 cfs, the latter being 175% of the former. Considering the peak test flood pool elevation of 166.3' (MDC Datum) freeboard to the top of the dam is 1.5 ft.

5.5 Dam Failure Analysis

A dam failure analysis was made in accordance with the Corps of Engineers' Guidelines. Failure was assumed with the water level at the test flood elevation of 166.3' MDC Datum. Assuming a dam breach size of 164 ft. wide (40% of dam length) and 18.5 ft. high, the peak release rate was 20,000 cfs.

The height of the flood wave was approximately 11 ft. at the first cross-section (Sta. 5+0). Two additional cross-sections were analyzed, the last one being 5,000 ft. downstream from the dam. Flood routing computations were done taking into consideration the available valley storage. The resulting flood elevations and the values of the routed flood flows are shown in Appendix D. At the last cross-section (Sta. 50+0) the flow reduces to 16,000 cfs and the wave height to 10.5 ft. which still have considerable potential of causing substantial flooding of properties further down from Brookside Boulevard and

North Main Street. The depths of flow in the stream in the area of 15 downstream houses considered with the last one being 2,700 ft. from the dam are 4 feet (pre-failure) and 11 feet (post-failure). These houses which are located on Asylum Avenue, Fox Chase Lane, Pioneer Drive and Harvest Lane, are subject to flooding under test flood conditions. Under dam failure conditions, they will be flooded to depths of 1 to 3 feet above their first floor elevations.

Many houses, streets and State Route 4 (Asylum Avenue) will be flooded as a result of the dam breach. The economic loss may be excessive and more than a few lives may be lost. As such, the Bugbee Dam is classified as 'high' hazard potential.

Dam breach calculations are included in Appendix D.

EVALUATION OF STRUCTURAL STABILITY
Section 6

6.1 Visual Observation

The visual inspection revealed no structural stability problems; however, as shown in the detail photos in Appendix C, two to three inches of snow covered the dam embankment and emergency spillway. Areas of erosion and rutting and animal burrows may have been obscured by the snow cover. The reservoir was also dry at the time of inspection; therefore, seepage that may exist when water is impounded in the reservoir was not observed.

6.2 Design and Construction Data

A review of the available data indicates that the dam and spillway were adequately designed for structural stability (See pages B-2 to B-11 in Appendix B).

6.3 Post Construction Changes

The available data does not indicate any post construction changes.

6.4 Seismic Stability

The dam is located in Seismic Zone No. 1, and in accordance with Corps of Engineers' guidelines does not warrant further seismic analysis at this time.

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES
Section 7

7.1 Project Assessment

a. Condition

Based upon the visual inspection of the site with the snow cover, review of available data and past performance, the project appears to be in good condition. No evidence of structural instability was observed. The dam is generally in good condition with areas of some concern which require maintenance and/or monitoring.

Any structural instability that might occur due to seepage when the reservoir contains floodwater could not be evaluated, since the reservoir was dry.

Based upon "Preliminary Guidance for Estimating Maximum Probable Discharge" dated March, 1978, peak inflow to the lake is 4,000 cfs ; peak outflow is 3,400 cfs with the water level 1.5 feet below the dam crest. Based upon our hydraulic computations, the spillway capacity with the pool level to the top of dam is 6,000 cfs.

b. Adequacy of Information

The information available is such that an assessment of the condition and stability of the project can be made.

c. Urgency

It is recommended that the measures presented in Section 7.2 and 7.3 be implemented within two years of the owner's receipt of this report.

7.2 Recommendations

It is recommended that the owner employ a qualified registered engineer to:

1. Inspect the dam during the time that water is impounded in the reservoir with particular attention to locating possible seepage.
2. Inspect the dam at a time when there is no snow cover with particular attention to locating areas of erosion and settlement and animal burrows.

The owner should implement the recommendations of the engineer.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

The following measures should be undertaken and continued on a regular basis.

1. Surveillance should be provided by the owner during periods of unusually heavy precipitaton and high discharge. The owner should develop and implement a downstream warning system to be used in case of emergencies at the dam.
2. A formal program of operation and maintenance procedures should be instituted and fully documented to provide accurate records for future reference including recorded pool elevations during flood impoundments.

3. A comprehensive program of inspection by a registered professional engineer qualified in dam inspection should be instituted on a biennial basis.

4. Remove the pile of rip-rap situated in front of the trash rack at the low level inlet at the intake riser.

5. Repair and paint metal safety mesh cover on top of the impact basin.

7.4 Alternatives

This study has identified no practical alternatives to the above recommendations.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Bugbee Reservoir Dam

DATE 12/16/80

TIME Afternoon

WEATHER Cold & Clear 2 to 3" of snow

W.S. ELEV. _____ U.S. _____ D.S.

PARTY:	DISCIPLINE:
1. Gerald Buckley (GB)	Soils & Structures
2. Ed Henderson (EH)	Geotechnical
3. Wesley J. Wolf (WW)	Hydraulics
4.	
5.	

PROJECT FEATURE	INSPECTED BY
1. Dam Embankment (Earthfill)	GB, EH, WW
2. Principal Spillway - Intake Riser	GB, EH, WW
3. Principal Spillway - Outlet	GB, EH, WW
4. Emergency Spillway	GB, EH, WW
5.	
6.	
7.	
8.	
9.	
10.	

PERIODIC INSPECTION CHECK LIST

PROJECT Bunbee Reservoir DATE 12/16/80

PROJECT FEATURE Earthfill Dam NAME EH, GB, WW

DISCIPLINE _____ NAME _____

AREA ELEVATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	167.8' MDC Datum
Current Pool Elevation	No Pool - Dry Dam
Maximum Impoundment to Date	Unknown
Surface Cracks	None Observed*
Pavement Conditions	N/A
Movement or settlement of crest	None Observed* (Minor Vehicle Ruts)
Lateral movement	None Observed
Vertical alignment	Looks Good *
Horizontal alignment	Looks Good
Conditions ~~at abutment &~~ at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None Observed
Trespassing on Slopes	Very Minor *
Sloughing or Erosion of Slopes or Abutments	None Observed *
Rock Slope Protection-Riprap Failures	N/A
Unusual Movement or Cracking at or Near Toes	None Observed *
Unusual Embankment or Downstream Seepage	None Observed (Dr. Dam)
Piping or Boils	None Observed (Dry Dam)
Foundation Drainage Features	Outlets Clean
Toe Drains	N/A
Instrumentation System	N/A
	*Note: 2 To 3" of snow at Time of Inspection

PERIODIC INSPECTION CHECK LIST

PROJECT Bugbee Reservoir Dam DATE 12/16/80

PROJECT FEATURE Intake Riser & Channel NAME EH, GB, W/W

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	Natural & Excavated Channel
Slope Conditions	Good
Bottom Conditions	Good (Rocky)
Rock Slides or Falls	None
Log Boom	N/A
Debris	Clean
Condition of concrete lining	N/A
Drains or Weep Holes	N/A
b . Intake Structure	Riser for Pipe
Condition of Concrete	Good
~~Stop Logs and~~ Slots	Minor Clogging by STONES Apparently Thrown in by Vandels.

PERIODIC INSPECTION CHECK LIST

PROJECT Bunbee Reservoir Dam DATE 12/16/80

PROJECT FEATURE Outlet Structure & Channel NAME EH, GR, WW

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	Impact Basin
General Condition of Concrete	Good
Rust or Staining	Rusting of Safety Cover
Spalling	None
Erosion or Cavitation	None
Visible Reinforcing	None
Any Seepage or Efflorescence	None
Condition at Joints	Good
Drain Holes	Clean
Channel	Excavated Channel
Loose Rock or Trees Overhanging Channel	None
Condition of Discharge Channel	Clean

PERIODIC INSPECTION CHECK LIST

PROJECT Bugbee Reservoir Dam DATE 12/16/80

PROJECT FEATURE Emergency Spillway NAME EH, GB, WW

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel (Before Crest)	
General Condition	Good*
Loose rock overhanging channel	None*
Trees Overhanging Channel	None
Floor of Approach Channel	Good*
b. Weir and trailing walls	
General Condition of Concrete	N/A
Rust or Staining	
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	
c. Discharge Channel (After Crest)	
General Condition	Good*
Loose Rock Overhanging Channel	None*
Trees Overhanging Channel	None
Floor of Channel	Good*
Other Obstructions	None*

Note: Emergency Spillway is Grass Covered Earth.

* Note 2 to 3" of snow at the time of inspection

APPENDIX B

ENGINEERING DATA

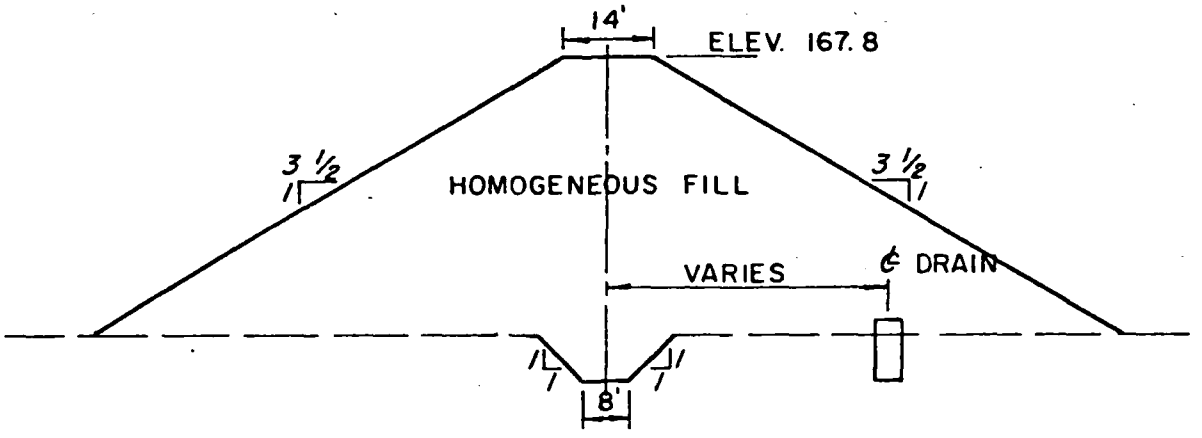
ENGINEERING DATA CHECKLIST

ITEM	AVAILABILITY	LOCATION
LOCATION MAP	Available	Metropolitan District Commission, Hartford, CT
AS-BUILT DRAWINGS	Available	U.S. Soil Conservation Service Storrs, CT.
HYDROLOGIC & HYDRAULIC DATA	Available in Design Report	
SUBSURFACE EXPLORATIONS	Available in Design Report	
SOIL TESTING	Available in Design Report	
GEOLOGY REPORTS	Available in Design Report	
CONSTRUCTION HISTORY	Not Available	
OPERATION RECORDS	Not Available	
INSPECTION HISTORY	Available	State of Connecticut Department of Environmental Protection
DESIGN REPORT	Available	U.S. Soil Conservation Service Storrs, CT.
DESIGN COMPUTATIONS		
HYDROLOGIC & HYDRAULIC	Available in Design Report	
DAM STABILITY	Available in Design Report	

U. S. DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

DESIGN REPORT SUMMARY

I.	Watershed data		
	A. Structure class	(c)	
	B. Drainage area	1190	Ac.
	C. Time of concentration - T_c	1.5	Hrs.
	D. Hydrologic curve number - C_n		
	1. Moisture condition II	68	
	2. Moisture condition III	88	
II.	Principal spillway		
	A. Conduit		
	1. Size (I.D.)	48	In.
	2. Length	108.33	Ft.
	B. Riser		
	1. Size	8x9	Ft.
	2. Height	4.5	Ft.
	C. Weir length	24	Ft.
	D. Low stage port	1x9	
	E. Type of energy dissipator	impact basin	
III.	Emergency spillway		
	A. Width	200	Ft.
	B. Side slopes	3:1	
	C. Length of level section	185	Ft.
	D. Exit slope	0.0225	Ft/Ft.
	E. Maximum velocity at control section (D.H.W.)	6.57.05	Ft/Sec.
	F. Duration of flow (D.H.W.) through emergency spillway		Hrs.
	G. Frequency of use	Less than once in 100 years	
IV.	Earth fill		
	A. Height	14	Ft.
	B. Volume	8050	C.Y.
	C. Compaction	Class "A"	



Typical Cross Section

ENGINEERING & WATERSHED PLANNING UNIT, UPPER DARBY, PA.

U. S. DEPARTMENT OF AGRICULTURE – SOIL CONSERVATION SERVICE

Element of Structure	Determining Factor	Elevation	Surface Area Acres	Storage		Inflow		Peak Outflow c.f.s.
				Acre-Feet	Inches*	Volume Inches*	Rate c.f.s.	
Crest of riser	Sediment accumulation	152.00	6.74	3.00[1]	0.03	-	-	108
Crest of emergency spillway	100-year frequency storm, moisture condition III	163.3	119.2	725[1]	7.31	9.24	2030	240
Design high water	1 X 6-hour point rainfall, moisture condition III	165.75	135.0	1070[1]	10,79	14.46	6750	1880
Top of dam	2.5 X 6-hour point rainfall, moisture condition II	167.8	154.0	1180[1]	11.90	19.15	8820	3420

*Inches of runoff from controlled area of 1190 acres.
Time required to empty flood storage is 48 hours.

[1] Includes 3 acre-feet of sediment.

ENGINEERING & WATERSHED PLANNING UNIT, UPPER DARBY, PA.

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO : 1958 O-470067

STATE Conn		PROJECT SBPR Site #2 (Bugbee)		
BY WTF	DATE 1/26/65	CHECKED BY	DATE	JOB NO CN-419-H
SUBJECT Hydrology Summary				SHEET 1 OF 15

PRINCIPAL SPILLWAY

The principal spillway hydrograph in the Watershed Work Plan prepared by a consultant was based on 12 inches of runoff. The routed high water elevation was 163.6 MDD, which was verified when final design was started, and land acquisition was initiated on this basis. Subsequent encroachments of filled areas within the flood pool made it necessary to reduce the runoff of the Principal Spillway storm to hold the maximum routed water surface to the above elevation of 163.6. As the Principal Spillway design hydrograph is from 30% - 50% in excess of that of the 1955 Hurricane "Diane", the consultant and the EWP Unit concurred in the decision to reduce the runoff, since it does not affect the economic justification for the project and exceeds minimum SCS criteria. The total runoff used was then 11.2 inches.

EMERGENCY SPILLWAY

A revision in the final design of Site #1, the Talcott site, provided an emergency spillway which would discharge into the watershed of the subject site. Therefore, emergency spillway flow from Site #1 was added to the inflow hydrograph to Site #2, assuming a lag time equivalent to the time of concentration.

The emergency spillway width was estimated and exit channel velocities were well within accepted criteria. The soil is classed as Enfield silt loam and will be placed in the Emergency Spillway cut which will be at or just above the hardpan zone.

FREEBOARD

Freeboard of 2' was added to the elevation of the routed high water elevation of the Emergency Spillway storm. This was checked by routing the Freeboard Hydrograph.

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O—479661

STATE CONN		PROJECT SBPR #2		
BY NTF	DATE	CHECKED BY	DATE	JOB NO. CN-419-H
SUBJECT Basic Watershed Data				SHEET 2 OF 15

Time of Concentration :

T_c = 1.5 hrs. based on information supplied to consultant by SCS, and modified somewhat in analysis of individual sites

Soil Cover Complex Numbers :

Also based on information on the entire watershed by SCS, the soil cover complex numbers for this sub-watershed are :

Soil Moisture Condition II = SCC No. 68

Soil Moisture Condition III = SCC No. 88

Sediment Design Data :

Rate of sediment accumulation computed on basis of 0.1 ton/acre of D.A/yr and estimated Dry Unit Wt. of 90 lb/cu ft = 0.0025508 Ac.ft./Acre

D.A = 1.86 Sq. Mi. or 1190 Acres

Sed. Volume = 1190 x 0.0025508 = 3.04 Ac.Ft.

T. R. Wire, State Conservation Engineer, SCS, Storrs, Connecticut

November 14, 1962

Rey S. Decker, Head, Soil Mechanics Laboratory, SCS, Lincoln, Nebraska

Connecticut WP-08, South Branch Park River, Site No. 2

ATTACHMENTS

1. Form SCS 354, Soil Mechanics Laboratory Data, 1 sheet.
2. Form SCS 355, Triaxial Shear Test Data, 1 sheet.
3. Form SCS 352, Compaction and Penetration Resistance Report, 2 sheets.
4. Form SCS 353, Filter Material, 1 sheet.
5. Geological Plans and Profiles.

DISCUSSION

FOUNDATION:

A. Classification: The material on the right abutments consists primarily of ML material. Sample 63W611 from the spillway is assumed to be representative of the material.

Basalt bedrock underlies the flood plain at depths of from about 3 to 7 feet. The flood plain sediments are logged primarily as SM with boulders at the surface at the base of the left abutment.

The upper portion of the left abutment is logged as a loose sand.

No foundation samples were submitted.

EMBANKMENT:

A. Classification: The material from the emergency spillway is classed as non-plastic ML. Samples from Borrow B are classed as SC-SM and GM or SM.

B. Compacted Density: Standard Proctor compaction tests on Samples 63W611 and 63W612 resulted in compacted densities of 110.5 and 114.0 p.c.f., respectively.

C. Shear Strength: A triaxial shear test was made on Sample 63W611. The test samples were molded to 95 percent of Standard Proctor density and soaked. The degree of saturation reached was low, but this is not expected to have a significant effect on non-plastic material such as this.

We would suggest strength values of $\phi = 35°$, $c = 0$ for design values.

2 -- T. R. Wire -- 11/14/62
Rey S. Decker
Subj: Connecticut WP-08, South Branch Park River, Site No. 2

SLOPE STABILITY:

For non-cohesive material such as this, drawdown is the most critical condition. The infinite slope analysis applies. With this analysis, the factor of safety obtained for a 3:1 slope is 0.96 and 1.14 for a 3 1/2:1 slope.

In addition to the infinite slope analysis, the sliding wedge method was used to check the stability of the downstream slope. With a drain considered at c/b = 0.6, the factor of safety obtained for a 2:1 downstream slope was 3.0.

In both analyses, the shear strength used was $\phi = 35°$, c = 0.

RECOMMENDATIONS

A. Centerline Cutoff: The cutoff trench should extend to the hard pan, as shown on ℄ profile, at least through the flood plain section. A minimum trench depth of 5 feet is suggested for the abutments. It may be necessary to deepen the trench somewhat on the left abutment in order for the trench to bottom below the loose kame sediments.

The trench should be backfilled with ML material like Sample 63W611 and compacted to a minimum of 95% of Standard Proctor density.

B. Principal Spillway: It appears that the conduit can be bedded either on bedrock or the hard pan layer. We assume from the graphical log of borings that the hard pan has a standard penetration resistance of 99 blows/foot in test hole 302. If this assumption is correct, the foundation may be considered as non-yielding.

We have also assumed that the hard pan layer is a tight SM and that seepage along the conduit will not be a problem.

C. Drain: We recommend a drain to control the phreatic line and also to provide a safe outlet for seepage that by-passes the cutoff trench.

A pipe and filter drain at about c/b = 0.6 is suggested. The suggested filter limits are shown on the attached Form SCS 354. SC-SM material like Sample 63W612 may be used between the ML embankment material and the filter material.

As an alternative to the graded filter suggested, it may be possible to use SP and GP material like that encountered in test hole 4 as a blanket or as a large trench drain. We do not know the gradation of this type material and, therefore, cannot make specific recommendations concerning its use.

3 -- T. R. Wire -- 11/14/62
Rey S. Decker
Subj: Connecticut WP-08, South Branch Park River, Site No. 2

D. Selection of Material: There is sufficient ML material like Sample 63W611 in the emergency spillway to construct the proposed embankment. Therefore, a homogeneous embankment is recommended. Material like Sample 63W612 should be used between the ML and the filter or drain.

All material should be placed at a minimum of 95% of Standard Proctor density with the moisture content controlled slightly on the wet side of optimum.

E. Slopes: The following slopes are recommended:

Upstream: 3 1/2:1.

Downstream: 2:1 with the phreatic line controlled by a drain.

Prepared by:

Lorn P. Dunnigan

Reviewed and Approved by:

Roland B. Phillips

Attachments

cc: T. R. Wire
H. M. Kautz, Upper Darby, Pennsylvania
H. Paul Tedrow, Storrs, Connecticut
W. M. Brown, Storrs, Connecticut

B. Surface Geology and Physiography

Bugbee Reservoir lies in the western portion of the Central Connecticut Valley. Set in an area of gentle topographic relief, the left and right abutments have slopes of 6 and 17 percent respectively. The width of the floodplain at the centerline of dam is approximately 50 feet.

The dam site itself is underlain by the Triassic Hampden Lava member of the Meriden formation. Glacial till is the predominant surficial cover at the site. This however becomes overlain by sediments of a small kame on a portion of the left abutment immediately north of the proposed centerline of dam. A ridge of comparable material is found approximately 800 feet west of the dam site and may be best described as an esker-type deposit.

No adverse geologic conditions such as landslides or structure were observed or detected during the site investigation. The condition of the streambanks and channel are stable and no erosional effect is anticipated as a result of the proposed structure.

II. Subsurface Geology

A. Centerline of Dam

Three holes were drilled along the centerline of the structure. In addition, two backhoe pits (TP-3 and TP-4) were dug for Haller Testing during their preliminary investigation. TP-4 was dug approximately 1.5 feet above top of dam on the left abutment in a small kame consisting of silty sands to 7.0 feet giving way to poorly graded sands and gravels. Holes 3 and 302 were drilled on the centerline of the dam. Depths to bedrock in the two holes were 7.5 and 5.0 feet respectively. The first four feet in hole 3 penetrated nested boulders. Underlying this is a very dense till. In hole 302 a very dense till was encountered at 2.5 feet with refusal at 5.1'. On each of the two holes 5 feet of rock was drilled to determine rock type and condition. The bedrock was the Hampden basalt and was in generally good condition. Some minor vertical and horizontal fracturing was noted in hole 3 whereas 3.5 feet of unbroken core was obtained from hole 302. Hole 2 was drilled as a 15 foot upstream offset from the centerline. The hole was located in what appeared to be the remnant of an old stream channel and abutment scour. No low volume-weight materials were found. Very dense till was encountered at 2.0 feet with refusal to the split spoon and casing being met at 7.5 feet.

GEOLOGY REPORT

Abutment materials range from loose silty sands and gravels grading into dense boulder till on the left abutment to relatively fine grained sands with low plasticity silts on the right abutment.

Depth to the watertable in the valley bottom is within 2.5' and the rate of recharge is estimated low to medium.

B. Centerline of Outlet Structure

Three holes were drilled along the approximate centerline of the conduit. Hole 302 has been described in the preceding section - Centerline of Dam. The downstream hole (#301) encountered bedrock at 2.9 feet. Some very minor vertical and horizontal jointing was found in the basalt. In hole 303, bedrock was drilled from 3.0 to 6.0 feet. Minor jointing again was common throughout the vertical section of rock. Groundwater is found within 1.5 to 2.5 feet of all holes drilled. The material overlying the bedrock in all holes drilled is primarily a fine grained silty sand having been tentatively classified as SM.

C. Emergency Spillway

Seven holes were dug in the emergency spillway area to determine the presence of bedrock and evaluate the adequacy of the materials for use as borrow. All holes were bottomed either at or below grade. The materials in all the holes are very similar and have been tentatively classified SM-ML pending laboratory analysis. The SM-ML is a very fine to fine grained sand, poorly graded with the silt fraction exhibiting a low plasticity. Some cobbles are present but boulders are rare. Hardpan was hit in pits 202 and 205 at a depth of 4.0 feet. No bedrock was observed in any of the test pits. One sample (#201) was taken from the area of maximum excavation for laboratory analysis for use as borrow. The material at the base of the spillway excavation will be the previously described SM-ML.

D. Borrow Area(s)

The anticipated primary borrow source area is the emergency spillway whose excavated material pending laboratory analysis is planned for the entire embankment. The conditions and materials have been described in the foregoing section.

A secondary borrow source area is also available from an esker-type ridge approximately 800 feet west of the proposed centerline. Five test pits were dug; 3 of which were sampled. All test pits except 105 were relatively coarse grained. Pit 105 which was on the periphery of a swamp encountered clay from 4.0 to 7.0 feet.

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	DRAWING NO. CN-419-G SHEET 3 OF 9 DATE 7/62

COMPUTATION SHEET
SCS-522 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O-470668

STATE	PROJECT			
Conn.	SCDP, Site 2, Hughes Reservoir			
BY	DATE	CHECKED BY	DATE	JOB NO
WHL	1/25/65	WIF	1/26/65	CN-419-E

SUBJECT

Embankment & Foundation Narrative

SHEET 1 OF _____

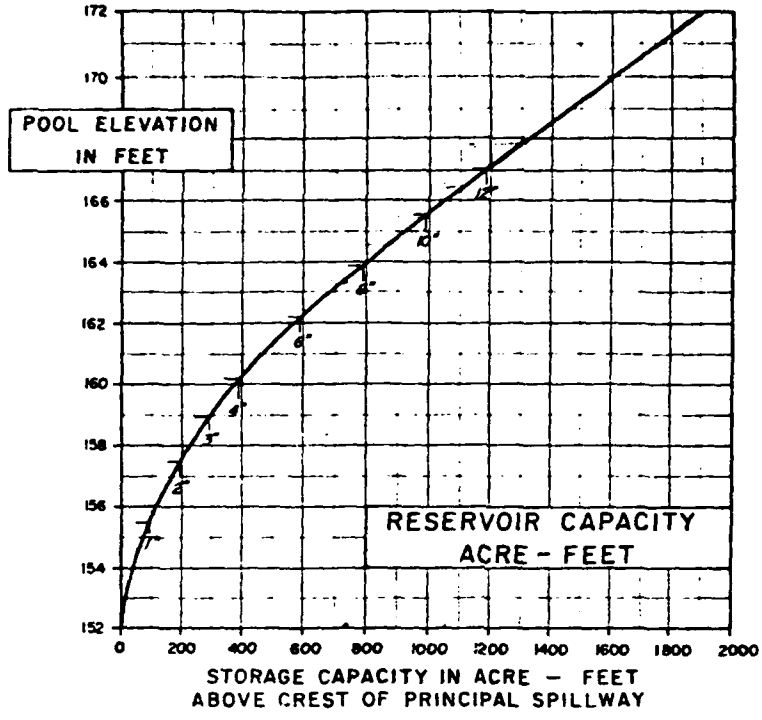
The upstream slope of the dam has been maintained at 3½:1 as suggested in the soils report. The downstream slope has been flattened to 3:1 to facilitate maintenance (mowing, etc.) but a trench drain is still used.

It has been attempted to modify the filter material limits to enable placement of the filter material directly against the proposed embankment materials (ML, emergency spillway borrow). This use will not require the opening of an additional borrow area for an extremely small amount of fill.

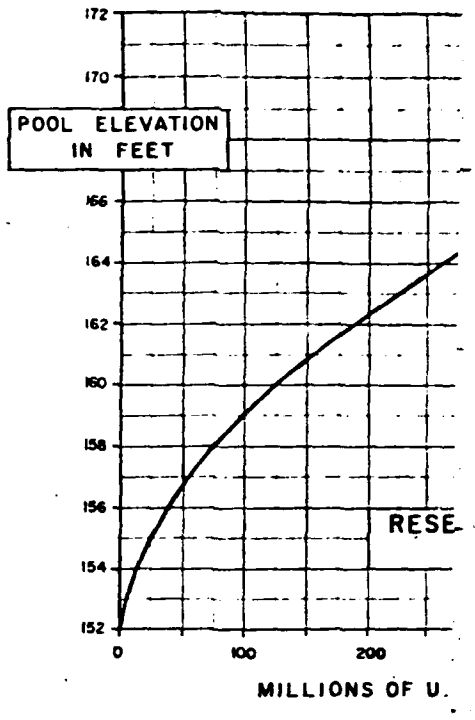
The principal spillway excavation side slopes have been maintained at 1:1 even in the rock excavation due to the non-plastic backfill material to be utilized. Also, at the intersection of the principal spillway & filter trench, the filter material completely surrounds the conduit to collect seepage following the pipe.

RESERVOIR C

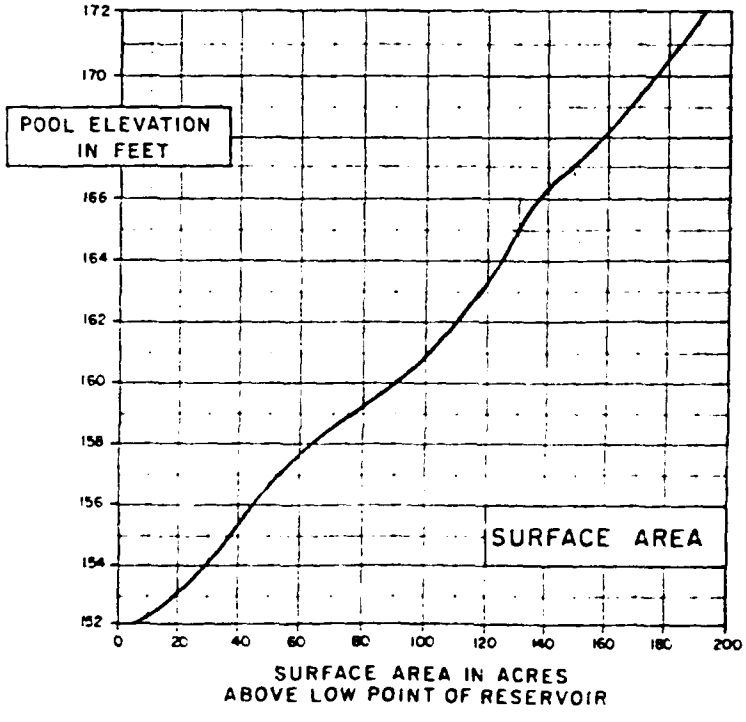
BUGBEE RESERVOIR-HART MEADOW BRC



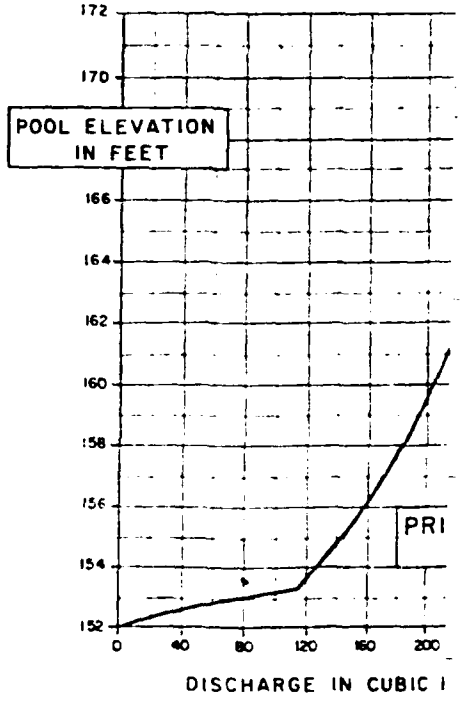
STORAGE CAPACITY IN ACRE – FEET
ABOVE CREST OF PRINCIPAL SPILLWAY



MILLIONS OF U.



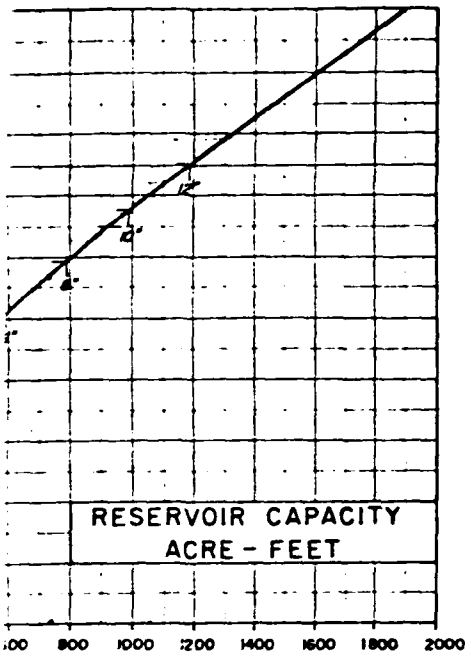
SURFACE AREA IN ACRES
ABOVE LOW POINT OF RESERVOIR



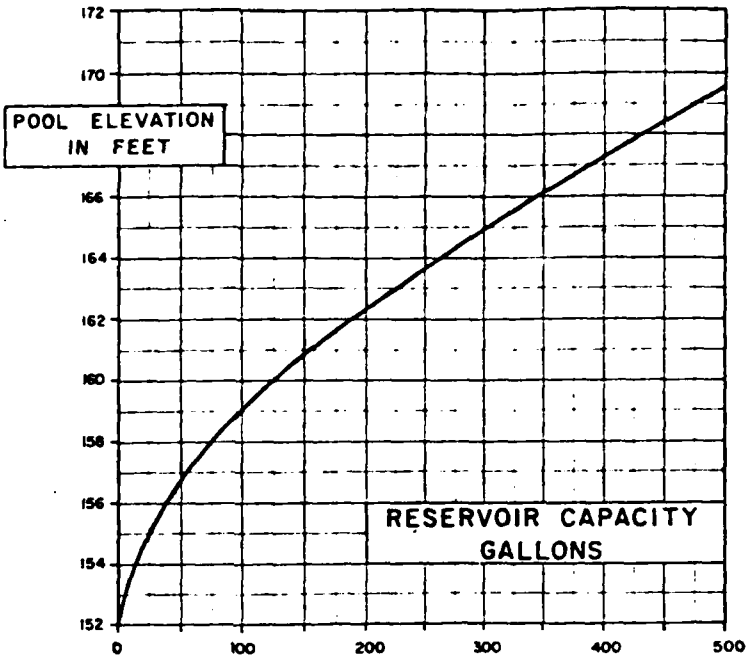
DISCHARGE IN CUBIC I

RESERVOIR OPERATION DAT

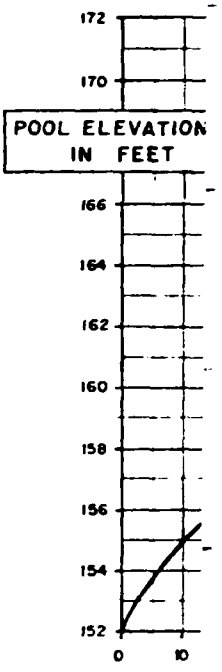
BUGBEE RESERVOIR-HART MEADOW BROOK-SOUTH BRANCH PARK

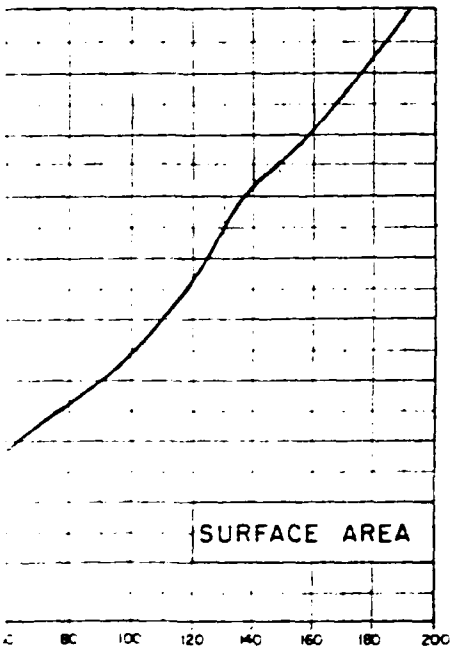


E CAPACITY IN ACRE - FEET
REST OF PRINCIPAL SPILLWAY

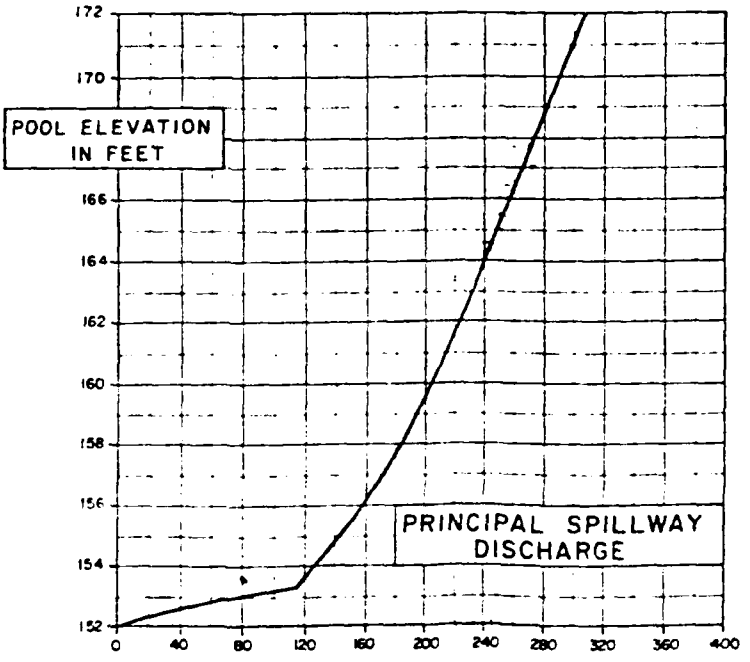


MILLIONS OF U.S. GALLONS

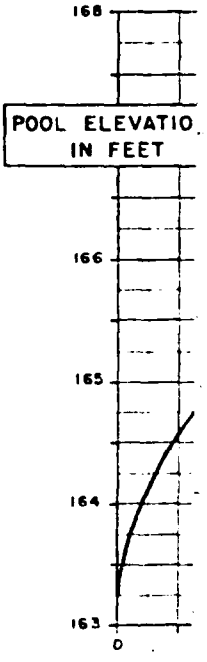




URFACE AREA IN ACRES
LOW POINT OF RESERVOIR

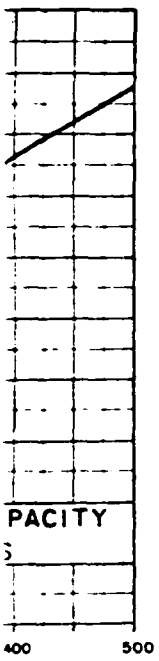


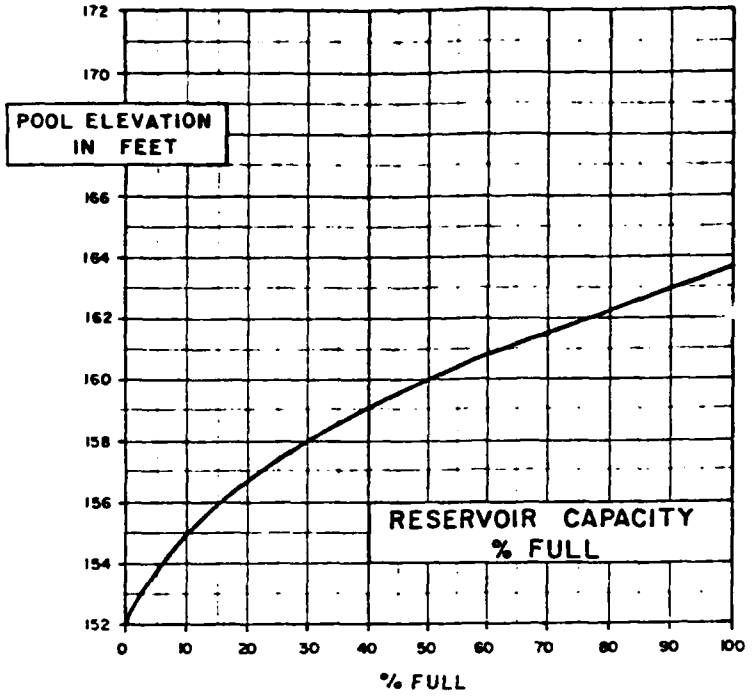
DISCHARGE IN CUBIC FEET PER SECOND

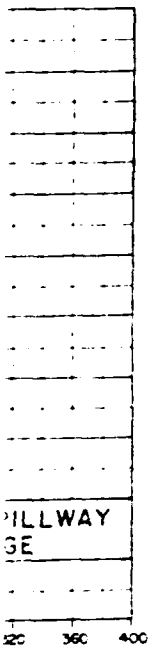


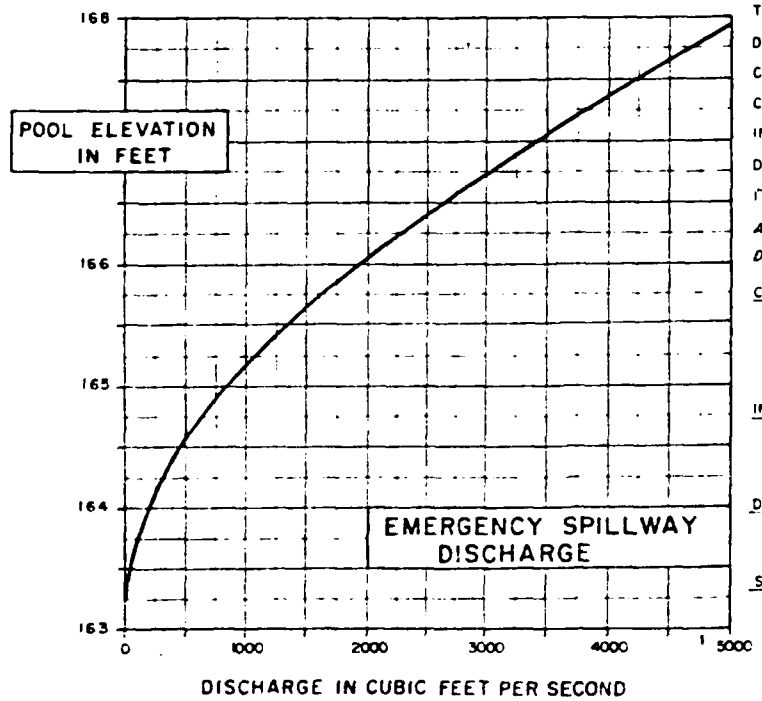
ATION DATA

)UTH BRANCH PARK RIVER WATERSHED









PERTINENT DATA

TOP OF DAM	EL 168.0
DESIGN HIGH WATER	EL 166.1
CREST EMERGENCY SPILLWAY	EL 163.3
CREST PRINCIPAL SPILLWAY	EL 152.0
INVERT LOW FLOW ORIFICE	EL 147.5
DRAINAGE AREA CONTROLLED	1.86 SQ M
1" OF RUNOFF =	99.19 ACRE-FEET

ALL ELEVATIONS REFER TO METROPOLITAN DISTRICT DATUM

CONSTRUCTED BY
STATE OF CONNECTICUT
DEPARTMENT OF AGRICULTURE & NATURAL RESOURCES
JOSEPH N. GILL, COMMISSIONER

IN ASSOCIATION WITH THE
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PUBLIC LAW 566 FUNDS

DESIGNED BY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATUS
UNDER DESIGN

Anderson-Nichols Associates February 1967

(3)

WATER RESOURCES UNIT - D.E.P.

OPERATION AND MAINTENANCE INSPECTION REPORT

PROJECT: West Hartford - Bugbee Reservoir DATE: August 7, 1979

INSPECTION PARTY: A. Horwarth, Soil Conservation Service; and A. Roberts, V. Galgowski, Department of Environmental Protection

ITEM	CONDITION S or U*	MAINTENANCE OR REPAIRS REQUIRED	DATE COMPLETED
I. Embankments			
A. Vegetation	S	Mow grass	
B. Rip rap	S		
C. Drains	S		
II. Principal Spillway			
A. Trash rack	S	Remove debris	
B. Gates	S		
C. Stilling Basin	S		
D. Conduit	S		
III. Emergency Spillway			
A. Vegetation	S		
B. Obstructions	S		
IV. Outlet Channels			
A. Slope protection	S		
B. Debris	U	Remove stone dam	
V. Reservoir Area			
A. Debris	S		
B. Stop logs	N/A		
VI. Miscellaneous			
A. Access road	S		
B. Fences	N/A		

Remarks: Rip rap used to build small dams in outlet channel should be placed back on the slopes.

Inspected by: Victor F. Galgowski Title Supt. of Dam Maintenance

* S = Satisfactory
U = Unsatisfactory
NA = Not applicable

BIBLIOGRAPHY

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2. Design of Small Dams, Revised Reprint, United States Department of the Interior, Bureau of Reclamation, United States Government Printing Office, Washington, D.C.

3. Soil Survey, Hartford County, Connecticut, United States Department of Agriculture, U.S. Government Printing Office, Washington 25, D.C. 1962

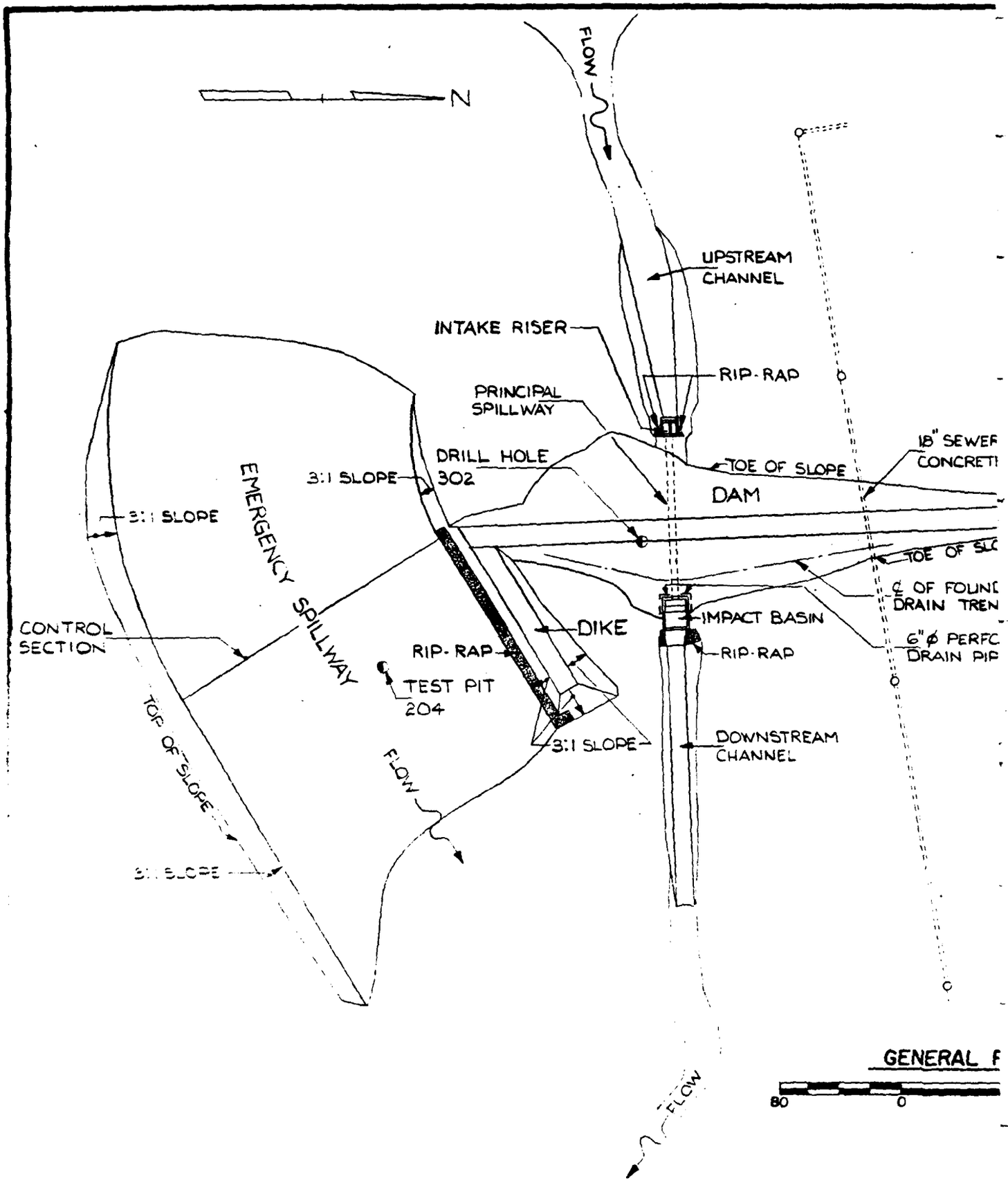
4. Donald M. Gray: Handbook on the Principles of Hydrology, Water Information Center, 1970.

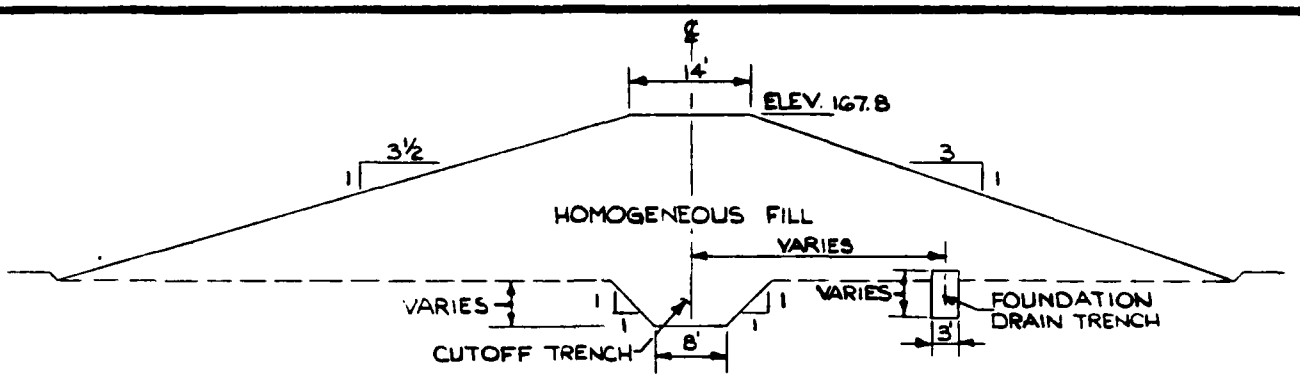
5. Hunter Rouse: Engineering Hydraulics, John Wiley and Sons, New York, 1950.

6. Victor L. Streeter: Fluid Mechanics, McGraw-Hill Book Company, Inc. 1958.

7. S.C.S. National Engineering Handbook, Hydrology Section 4, Soil Conservation Service, U.S. Department of Agriculture, 1972.

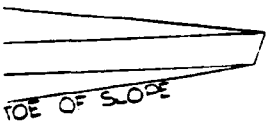
8. "South Branch Park River Watershed Protection Project, Design Report, Dam No. 2, Bugbee Reservoir", Hartford County, Connecticut U.S. Department of Agriculture Soil Conservation Service, Engineering & Watershed Planning Unit, Upper Darby, PA. April 1965.


N
FLOW
UPSTREAM CHANNEL
INTAKE RISER
RIP-RAP
PRINCIPAL SPILLWAY
DRILL HOLE 302
3:1 SLOPE
EMERGENCY SPILLWAY
3:1 SLOPE
TOE OF SLOPE
DAM
18" SEWER CONCRETE
TOE OF SLOPE
℄ OF FOUNDATION DRAIN TRENCH
IMPACT BASIN
6"ø PERFORATED DRAIN PIPE
RIP-RAP
DIKE
RIP-RAP
CONTROL SECTION
TEST PIT 204
TOP OF SLOPE
3:1 SLOPE
FLOW
3:1 SLOPE
DOWNSTREAM CHANNEL
FLOW
FLOW
GENERAL P
80
0



SECTION OF DAM
NOT TO SCALE

18" SEWER ENCASED IN
CONCRETE UNDER DAM



TOE OF SLOPE

OF FOUNDATION
RAIN TRENCH

6"ϕ PERFORATED
DRAIN PIPES

NOTE:
ALL ELEVATIONS REFERENCED TO METROPOLITAN DISTRICT DATUM.

REFERENCE:
DESIGN DRAWINGS SUPPLIED BY U.S. SOIL CONSERVATION SERVICE MANSFIELD, CONN.

NERAL PLAN

80 160

GOODKIND & O'DEA INC–SINGHAL ASSOCIATES(J.V.) ENGINEERS	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

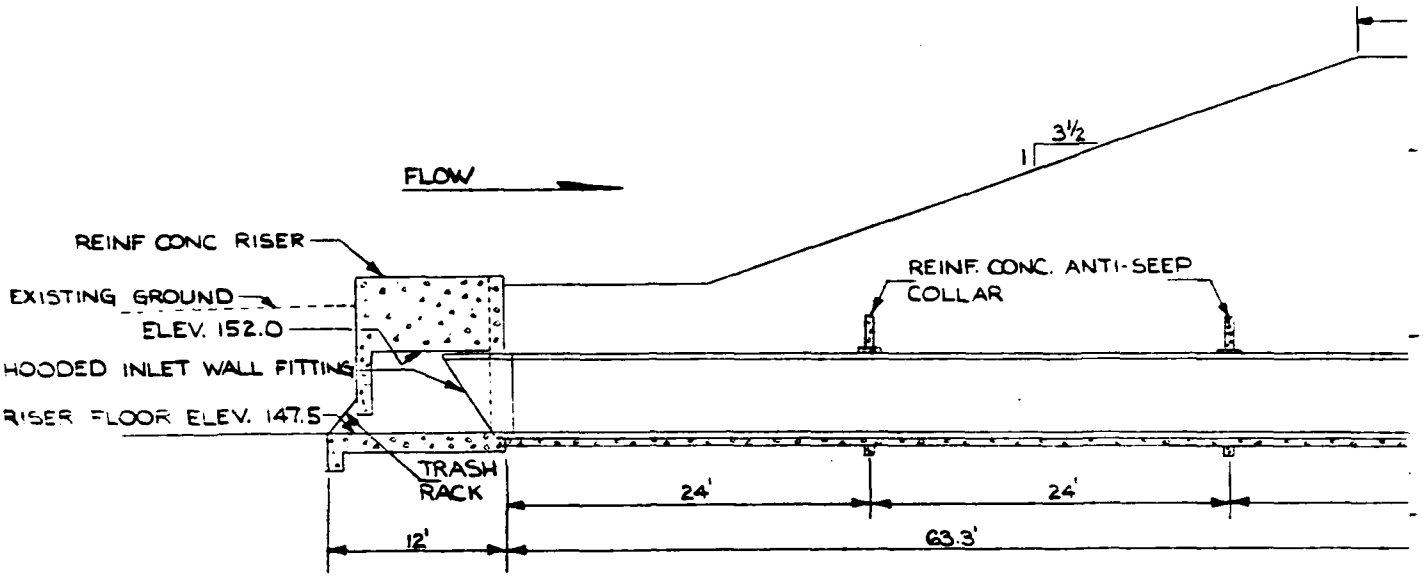
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

GENERAL PLAN AND SECTION OF DAM

BUGBEE RESERVOIR DAM
WEST HARTFORD, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE AS NOTED	
ETK	WJW	LJB	DATE JUNE 1981	SHEET 8-1

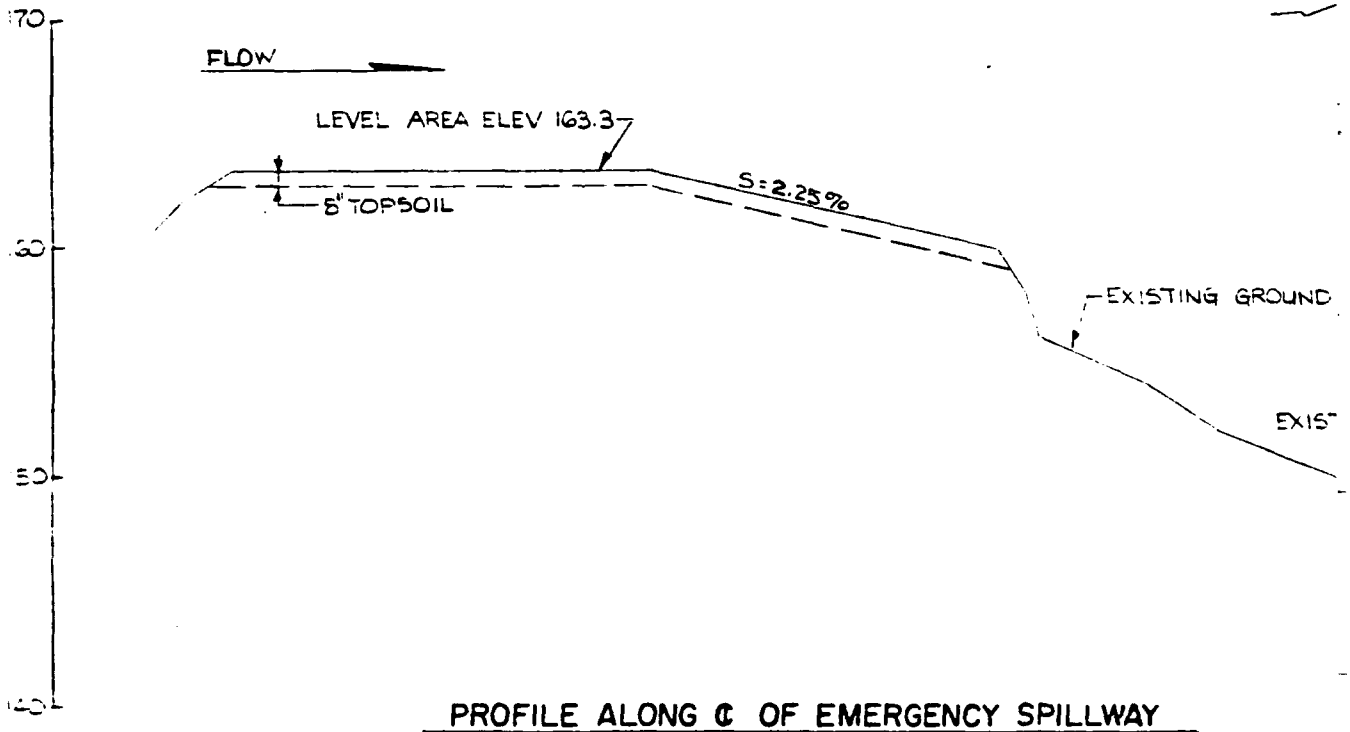
(2)



PROFILE ALONG ℄ OF

NOT TO

COMPACTED

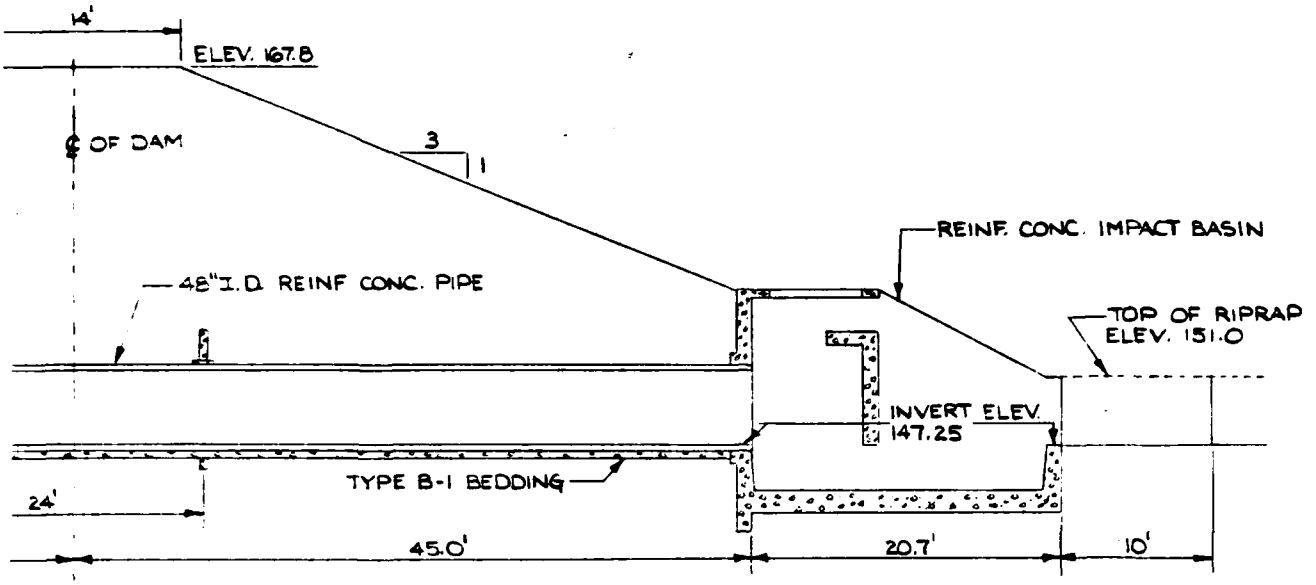


PROFILE ALONG ℄ OF EMERGENCY SPILLWAY

HORIZONTAL 80 0 80 160

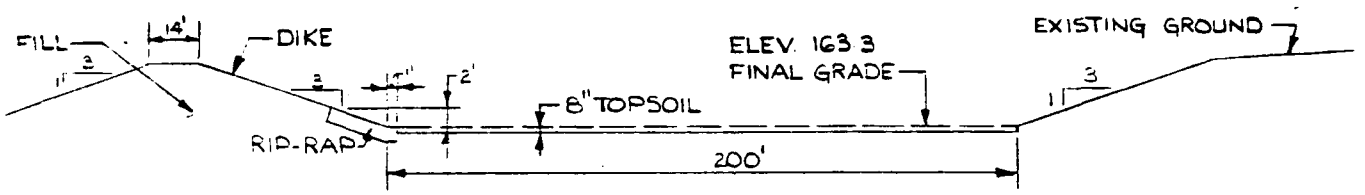
VERTICAL 8 0 8 16

(1)



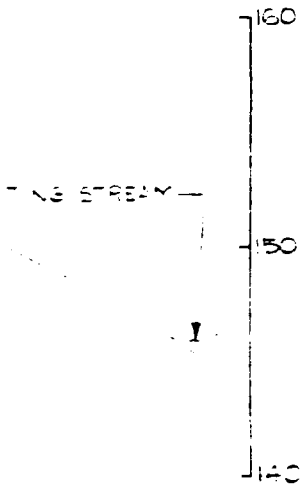
F PRINCIPAL SPILLWAY

0 SCALE



TYPICAL SECTION OF EMERGENCY SPILLWAY

NOT TO SCALE



NOTE:

ALL ELEVATIONS REFERENCED TO METROPOLITAN DISTRICT DATUM.

REFERENCE:

DESIGN DRAWINGS SUPPLIED BY U.S SOIL CONSERVATION SERVICE MANSFIELD, CONN.

GOODKIND & O'DEA INC—SINGHAL ASSOCIATES(J.V.) ENGINEERS	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PROFILES OF PRINCIPAL & EMERGENCY SPILLWAY

BUGBEE RESERVOIR DAM

WEST HARTFORD, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE AS NOTED	
ET#	W.J.W	L.J.B	DATE JUNE, 1981	SHEET B-2

DH-302, Principal Spillway, Sta. 4+55, Elev. 153.5'

N= 0 to 0.5 Topsoil

9 ▼ W.L., 1.5 feet, 5/19/62.

Sand, fine grained, poorly graded, red to brown, some fragmental trap rock, refusal at 5.1 feet.

99 SM

Bx

Basalt-Excellent condition - 3.5 feet of unbroken core among total recovery.

Bs

83% TD - 10.1 feet

TP- #204, Emergency Spillway, Borrow "A", Elev. 164.3'

Topsoil

Sand, fine grained, poorly graded, low plasticity fines est. 15%.

SM-ML

Sand, fine to medium grained, cobbles est. 5%.

SP-SM

TD-5.5 feet.

NOTES:

1) ALL ELEVATIONS REFERENCED TO METROPOLITAN DISTRICT DATUM.

2) SEE SHEET B-1 "GENERAL PLAN & SECTION OF PLAN" FOR LOCATION OF DRILL HOLE AND TEST PIT.

3) SEE DESIGN DRAWINGS FOR ADDITIONAL SUBSURFACE SOIL AND ROCK DATA.

REFERENCE:

DESIGN DRAWINGS SUPPLIED BY U.S. SOIL CONSERVATION SERVICE MANSFIELD, CONN.

GOODKIND & O'DEA INC.–SINGHAL ASSOCIATES, JV ENGINEERS	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

TYPICAL DRILL HOLE & TEST PIT FROM SUBSURFACE EXPLORATIONS

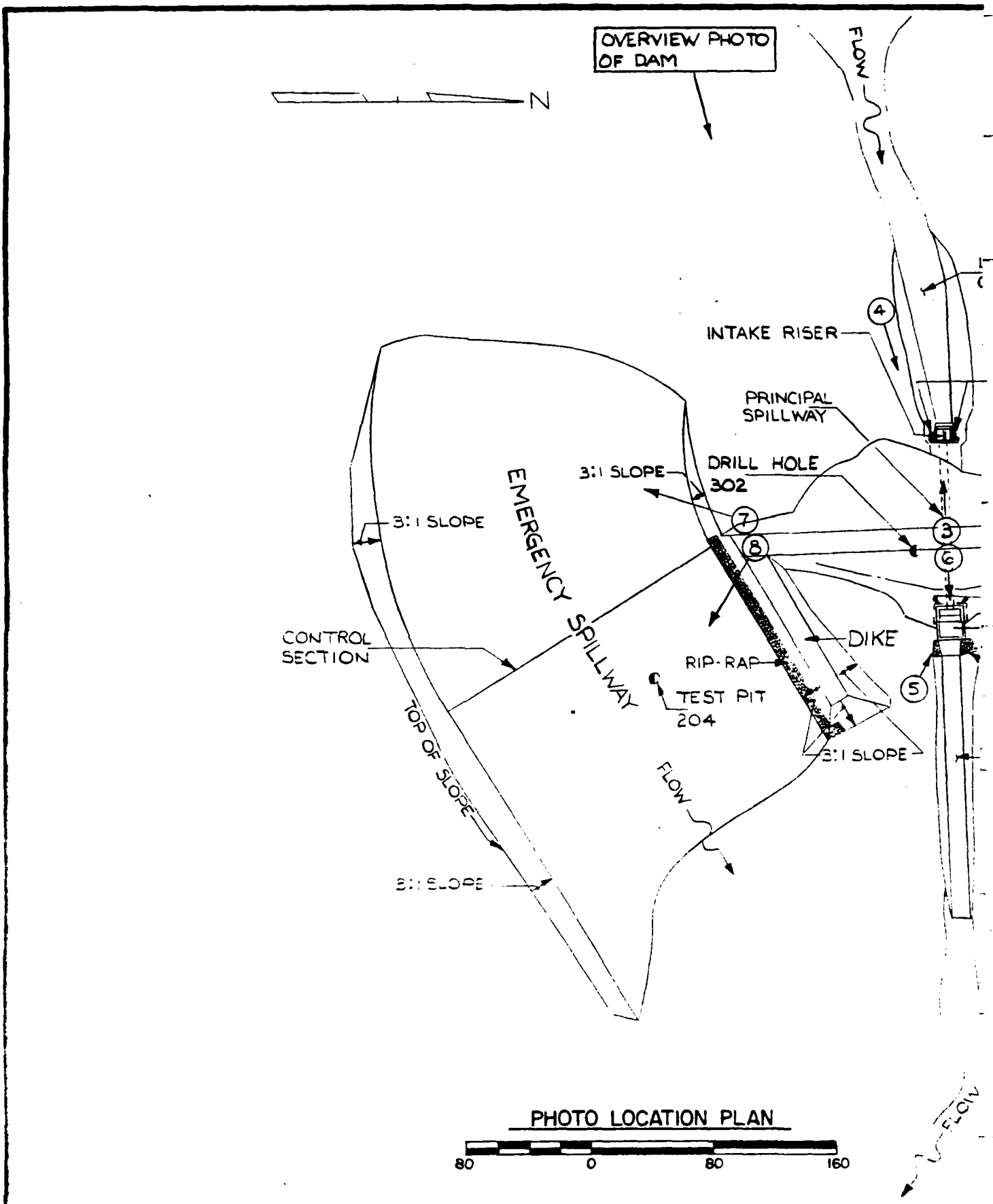
BUGBEE RESERVOIR DAM

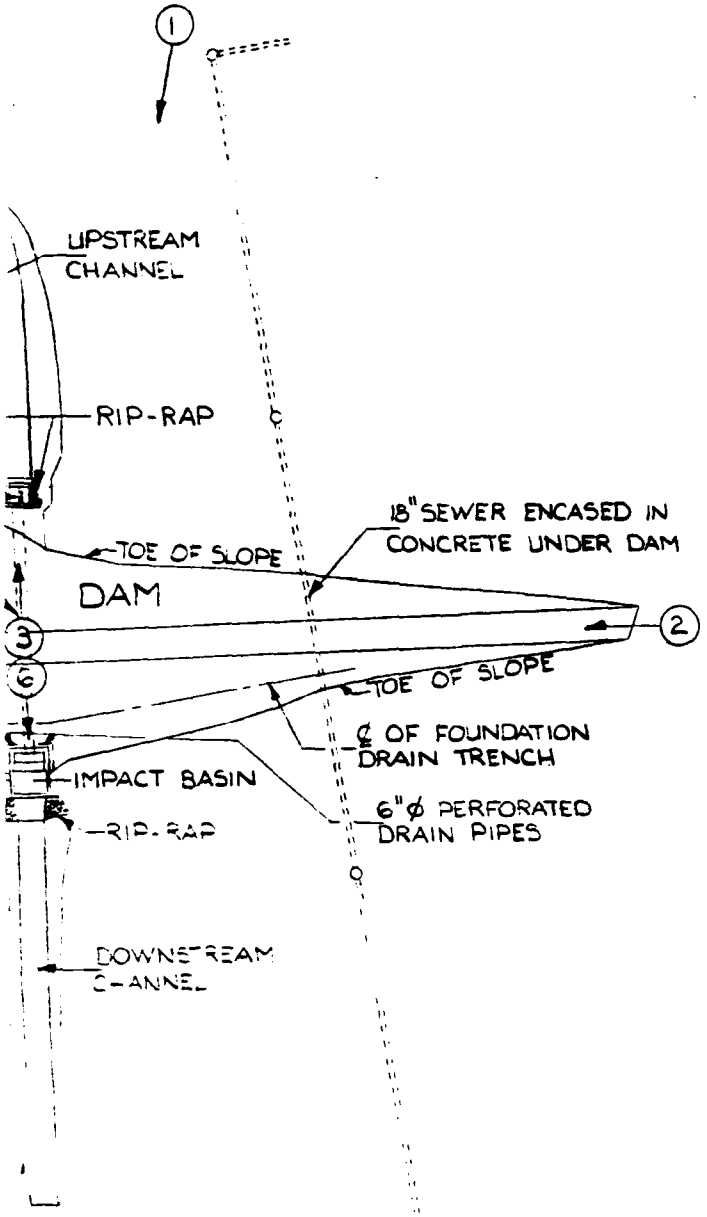
WEST HARTFORD, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE: NONE	
E.T.K.	W.J.W.	L.J.B.	DATE: MAY, 1981	SHEET B-3

APPENDIX C

DETAIL PHOTOGRAPHS


OVERVIEW PHOTO OF DAM
N
FLOW
INTAKE RISER
4
PRINCIPAL SPILLWAY
DRILL HOLE 302
3:1 SLOPE
3:1 SLOPE
EMERGENCY SPILLWAY
7
8
3
6
5
CONTROL SECTION
DIKE
RIP-RAP
TEST PIT 204
3:1 SLOPE
TOP OF SLOPE
FLOW
3:1 SLOPE
FLOW
PHOTO LOCATION PLAN
80
0
80
160



REFERENCE:
DESIGN DRAWINGS SUPPLIED BY U.S SOIL CONSERVATION SERVICE MANSFIELD CONN

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NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PHOTO LOCATION PLAN

BUGBEE RESERVOIR DAM

WEST HARTFORD, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE: AS NOTED	
E.T.R.	W.J.W.	L.J.B.	DATE: JUNE, 1981	SHEET C-1

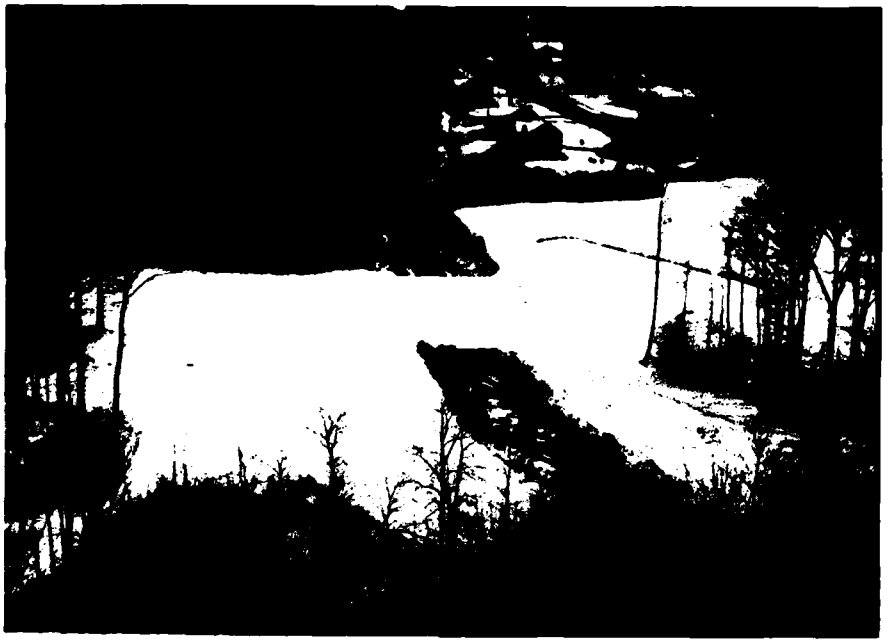


Photo 1 - View looking east along the upstream side of the dam embankment

Photo 2 - View looking south along the top of the dam embankment

Note:
Photo 1 taken December 20, 1980
Photo 2 taken December 16, 1980

Photo 3 - Upstream channel

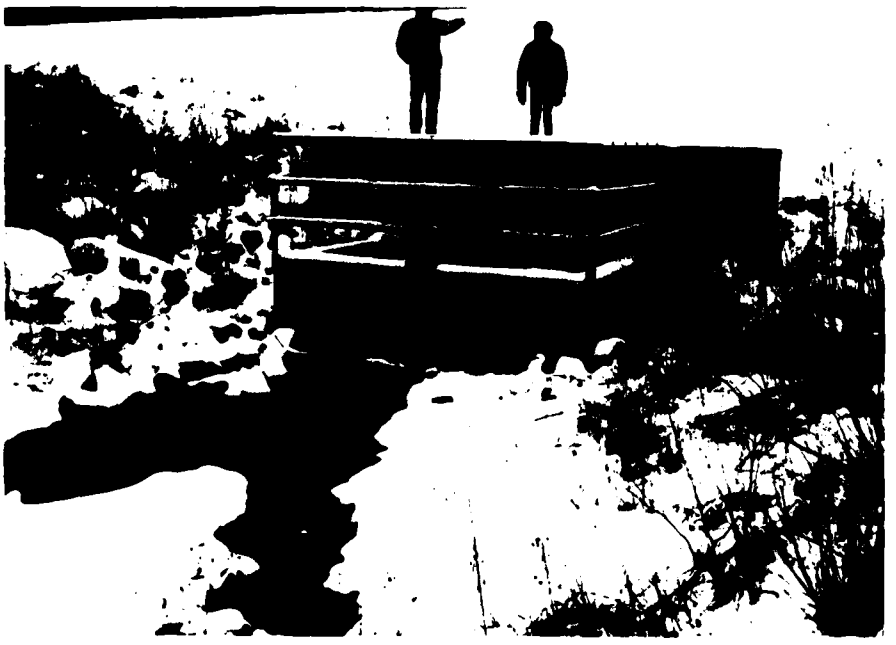


Photo 4 - Principal Spillway -
Intake Riser

Note:
Photos taken December 16, 1980

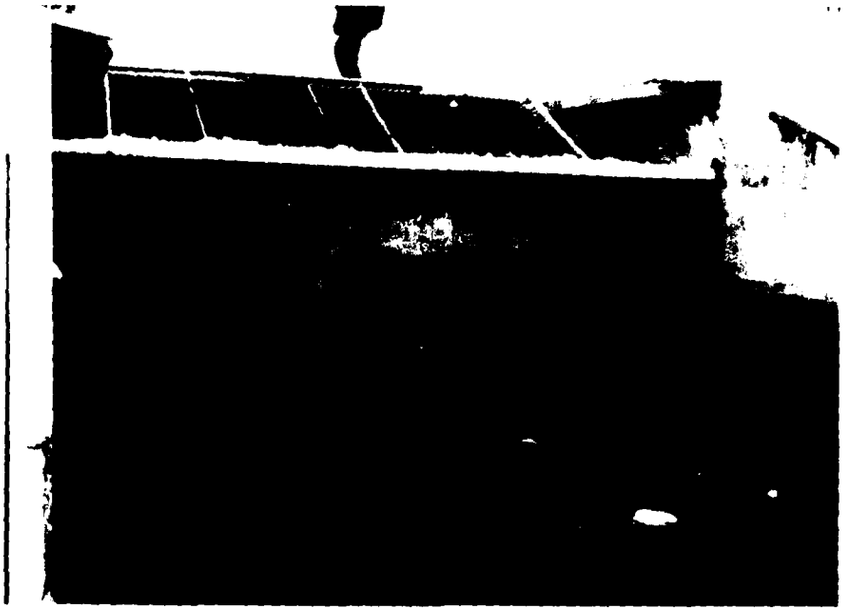


Photo 5 - Principal Spillway
Impact Basin

Photo 6 - Downstream channel

Note:
Phctos taken December 16, 1980

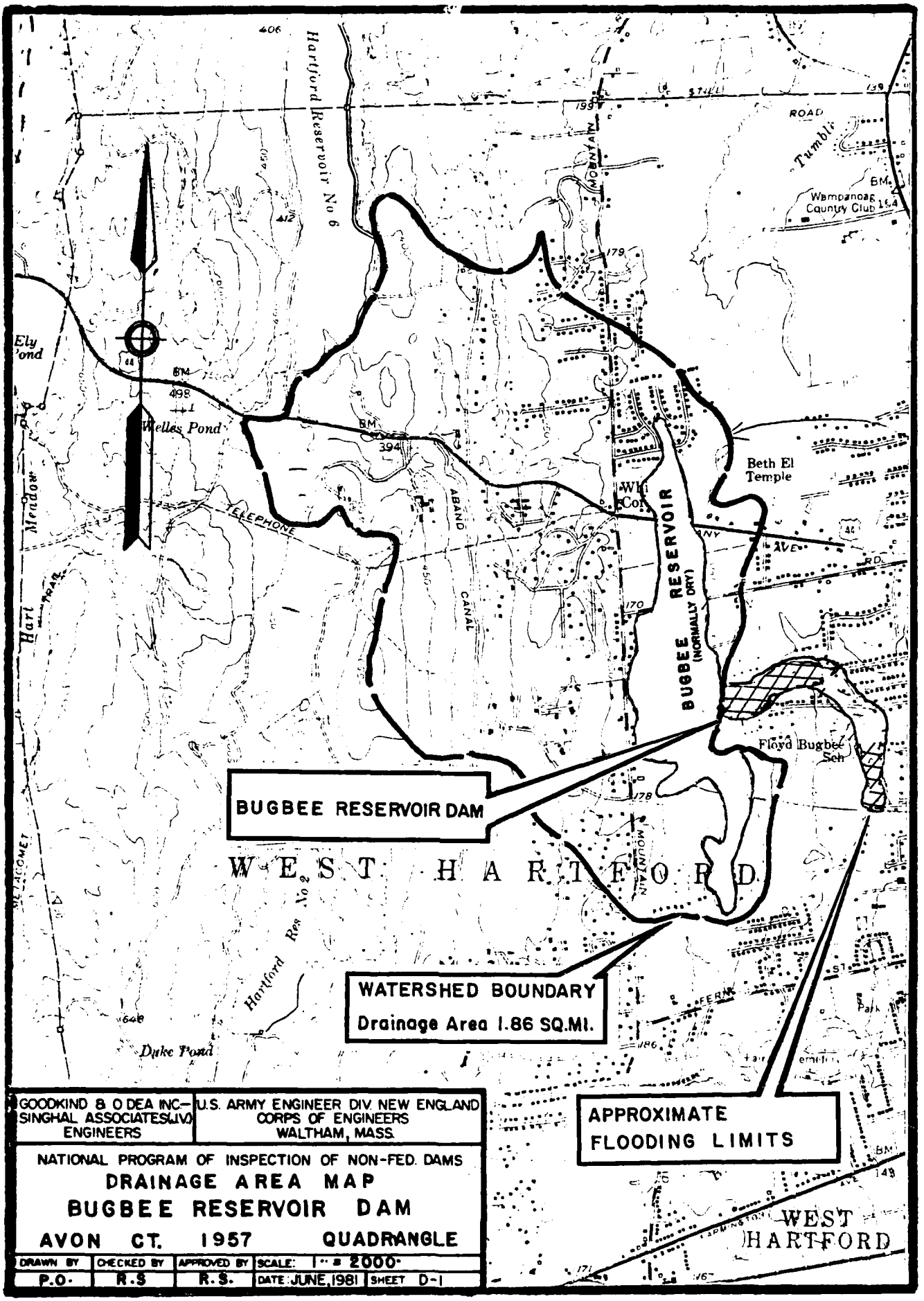
Photo 7 - View of inlet end of
the emergency spillway

Photo 8 - View of outlet end of
the emergency spillway

Note:
Photos taken December 16, 1980

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



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NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

DRAINAGE AREA MAP
BUGBEE RESERVOIR DAM
AVON CT. 1957 QUADRANGLE

DRAWN BY	CHECKED BY	APPROVED BY	SCALE: 1" = 2000'
P.O.	R.S	R.S.	DATE JUNE, 1981 SHEET D-1

SINGHAL ASSOCIATES
CONSULTING ENGINEERS
(CIVIL, HYDRAULICS, SANITARY)
827 MAPLEDALE ROAD, ORANGE, CT 06477
TEL: (203) 795-6562

Job BUGBEE RESERVOIR DAM
Sheet Number D-1
Date 2.24.1981
By R.S

TEST FLOOD

THE PROJECT RECEIVES RUNOFF FROM A DRAINAGE AREA OF 1.86 SQ. MILES, PLUS A 1680 CFS OVERFLOW FROM TALCOTT RESERVOIR.

THE TERRAIN HAS AN AVERAGE SLOPE OF 4.5%. HOWEVER, THERE ARE SEVERAL LARGE HILLS WITH 10% SLOPES. THE DRAINAGE AREA CAN BE CONSIDERED AS LYING BETWEEN 'FLAT & COASTAL' AND 'ROLLING' CATEGORIES BUT CLOSER TO THE 'FLAT & COASTAL'

ASSUMING A FACTOR OF $950 + \frac{1}{4}(2150-950) = 1250$ CFS/S.M.

THE CORPS OF ENGINEER' CHART,

RUNOFF = 1250 x 1.86
= 2325 CFS

ADDING AN OVERFLOW OF 1680 CFS FROM TALCOTT RESERVOIR
PMF = 2325 + 1680 = 4005, SAY 4000 CFS

SIZE AND HAZARD CLASSIFICATION

MAXIMUM HEIGHT OF THE DAM = 20.0 FT.

MAXIMUM IMPOUNDMENT UPTO TOP OF DAM = 1300 AC.FT.

AS THE STORAGE LIES BETWEEN 1000 AC.FT. AND 50,000 AC.FT. THE SIZE OF THE DAM IS = "INTERMEDIATE" ALTHOUGH THE HEIGHT DOES NOT EXCEED 40 FT.

THE HAZARD POTENTIAL IS 'HIGH' DUE TO THE EXISTENCE OF MANY STREETS, ROADS, PUBLIC BUILDINGS, LARGE NUMBER OF HOUSES AND THICKLY POPULATED COMMERCIAL AND INDUSTRIAL AREAS OF THE CITIES OF WEST HARTFORD AND HARTFORD ON THE DOWN-STREAM SIDE WHICH WILL BE FLOODED IN CASE OF DAM FAILURE. THERE IS POTENTIAL FOR 'EXCESSIVE' ECONOMIC LOSS IN ADDITION TO LOSS OF 'MORE THAN FEW' LIVES.

AS PER TABLE 3, PAGES D-12, D-13 OF THE "RECOMMENDED GUIDELINES FOR SAFETY INSPECTION OF DAMS" THE RECOMMENDED TEST FLOOD = PMF
= 4000 CFS.

SINGHAL ASSOCIATES
CONSULTING ENGINEERS
(CIVIL, HYDRAULICS, SANITARY)

827 MAPLEDALE ROAD, ORANGE, CT 06477
TEL: (203) 795-6562

Job BUGBEE RESERVOIR DAM
Sheet Number D-2
Date 2-24-1981
By R.S.

SPILLWAY CAPACITIES

THE SPILLWAY CONSISTS OF THE FOLLOWING:

1- 48" R.C. WATER PIPE (UPSTREAM INV. 147.5, WEIR CREST INV. 152.0)

1- EMERGENCY SPILLWAY, 200 FT. WIDE AT CONTROL SECTION, WITH CREST ELEV. 163.3

CAPACITIES AT VARIOUS ELEVATIONS AR TABULATED BELOW:

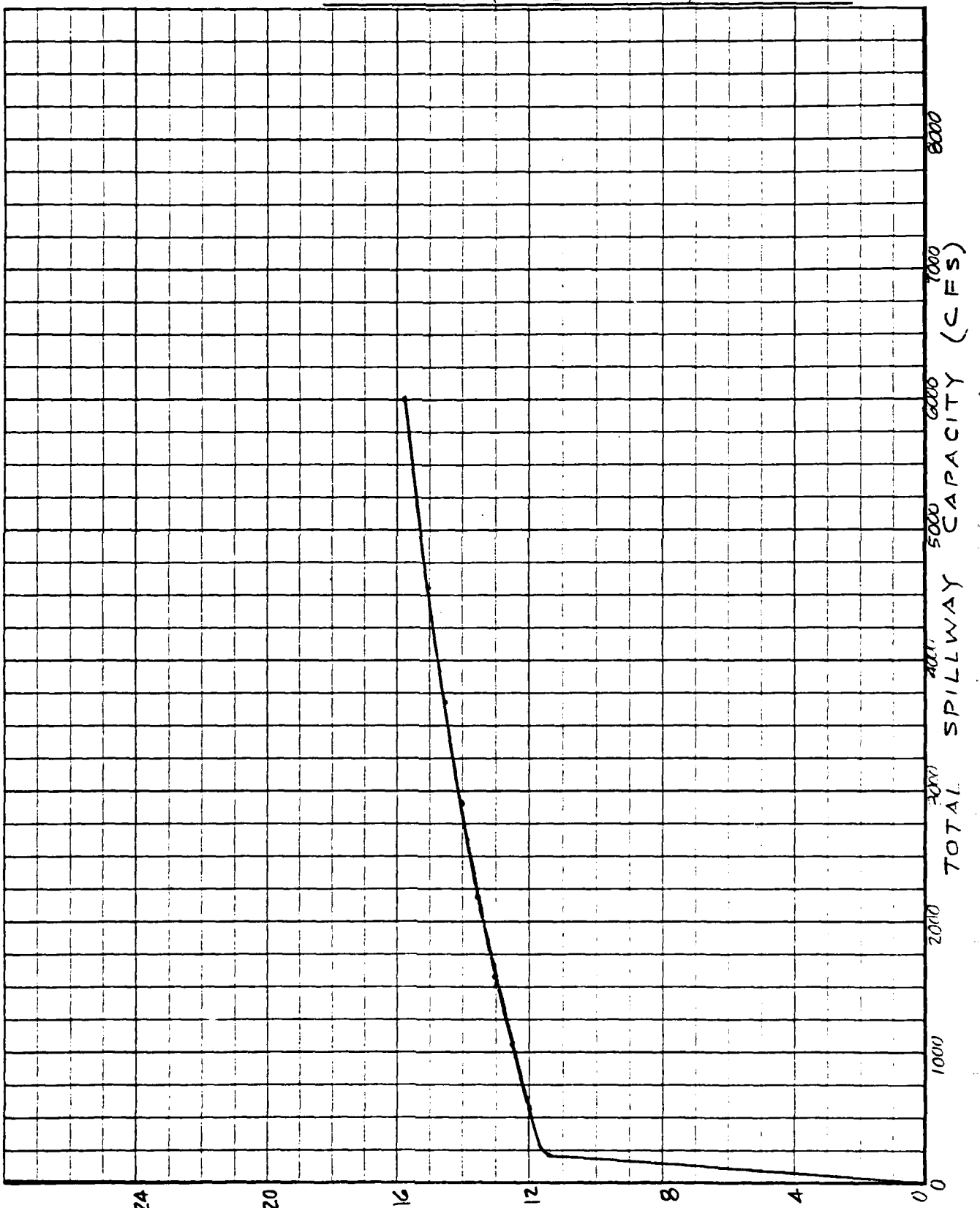
ELEVATION	CAPACITY - CFS		
	PRINCIPAL SPILLWAY	EMERGENCY SPILLWAY $Q=3.0\ LH^{3/2}$	TOTAL
163.3	235.0	0.0	235.0
164.0	240.0	351.0	591.0
164.5	244.0	789.0	1033.0
165.0	248.0	1330.0	1578.0
165.5	252.0	1958.0	2210.0
166.0	256.0	2662.0	2918.0
166.5	260.0	3435.0	3695.0
167.0	265.0	4270.0	4535.0
167.8	272.0	5728.0	6000.0

SINGHAL ASSOCIATES
CONSULTING ENGINEERS
(CIVIL, HYDRAULICS, SANITARY)

827 MAPLEDALE ROAD, ORANGE, CT 06477
TEL: (203) 795-6562

Job BUGBEE RESERVOIR DAM
Sheet Number D-3
Date 2·24·1981
By R·S

SPILLWAY CAPACITY CURVE



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Job BUGBEE RESERVOIR DAM
Sheet Number D-4
Date 2.24.1981
By R.S.

SURCHARGE STORAGES AND WATER SURFACE AREAS

RESERVOIR WATER SURFACE ELEVATION	HEIGHT ABOVE EMERGENCY SPILLWAY CREST (FT.)	WATER SURFACE AREA (ACRES)	SURCHARGE STORAGE CAPACITY (AC.FT.)
163.3	0.0	120.0	0.0
164.0	0.7	125.0	70.0
164.5	1.2	127.0	120.0
165.0	1.7	130.0	185.0
165.5	2.2	133.0	250.0
166.0	2.7	136.0	310.0
166.5	3.2	140.0	370.0
167.0	3.7	148.0	460.0
167.8	4.5	157.0	570.0

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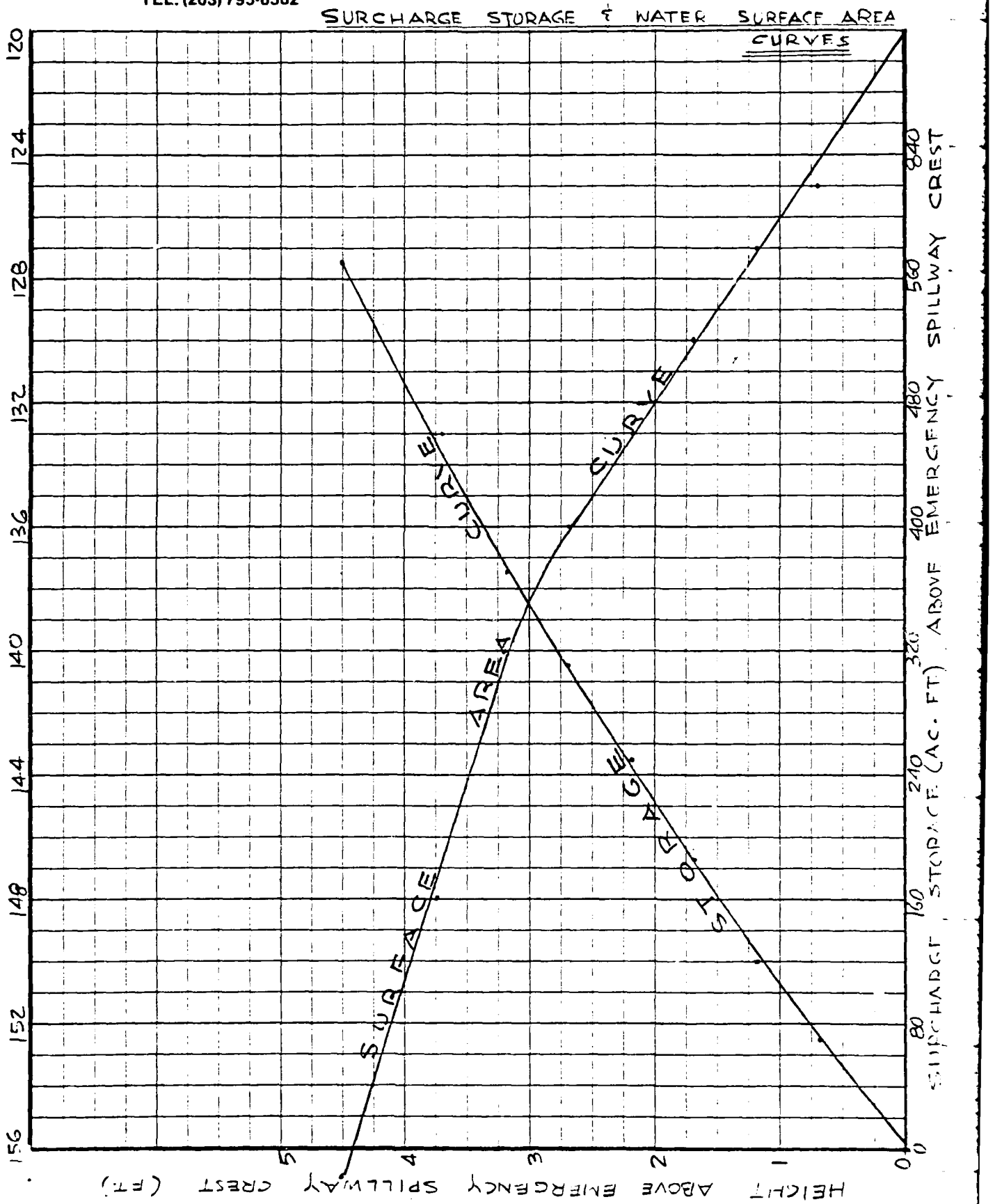
Job BUGBEE RESERVOIR DAM
Sheet Number D-5
Date 2-24-1981
By R.S



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Job BUGBEE RESERVOIR DAM-
Sheet Number D-6
Date 2-24-1981
By R.S.

INFLOW FLOOD HYDROGRAPH

TEST FLOOD (PMF) = 4,000 CFS
DRAINAGE AREA = 1.86 SQ. MILES

AS PER 'HYDROLOGY SECTION 4, S.C.S. NATIONAL ENGINEERING HANDBOOK':

$$q_p = \frac{484 \cdot A \cdot Q}{T_p}$$

AND $T_b = 2.67\, T_p$

WHERE T_b = TIME BASE OF HYDROGRAPH IN HOURS.

T_p = TIME IN HOURS FROM START OF RISE OF HYDROGRAPH TO ATTAINMENT OF PEAK.

q_p = PEAK RATE OF RUNOFF IN CFS

A = DRAINAGE AREA IN SQ. MILES

Q = TOTAL RUNOFF IN INCHES

SUBSTITUTING KNOWN VALUES OF A, Q AND q_p:

$$4000 = \frac{484 \times 1.86 \times 19}{T_p}$$

FROM WHICH $T_p = 4.3$ HOURS

AND $T_b = 2.67 \times 4.3 = 11.5$ HOURS

THE TRIANGULAR HYDROGRAPH ON THE FOLLOWING PAGE HAS BEEN DRAWN ACCORDINGLY.

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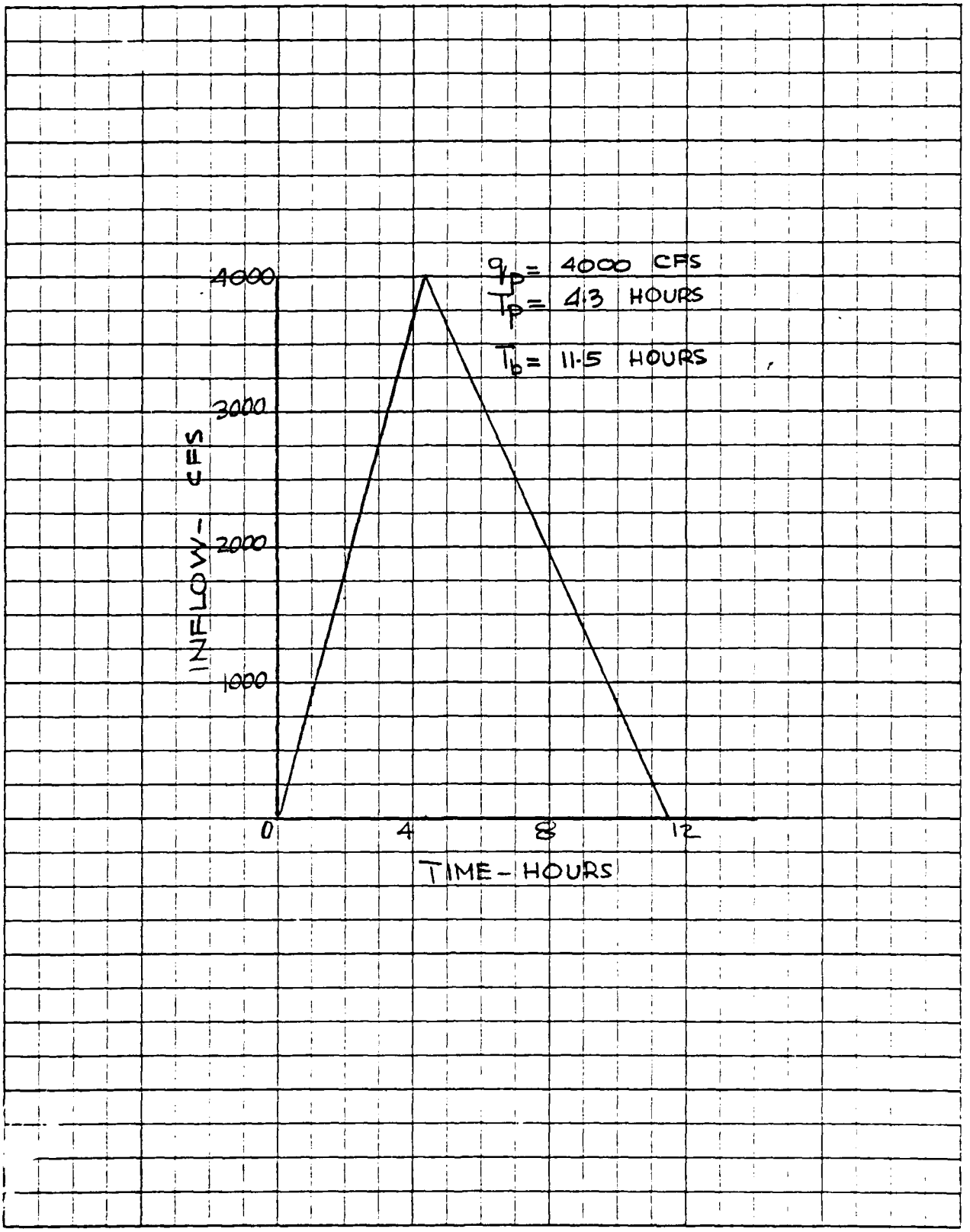
Job BUGBEE DAM
Sheet Number D-7
Date 5-5-1981
By R.S

INFLOW HYDROGRAPH



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Job BUCKET RESERVOIR DAM
Sheet Number
Date
By

TIME (HRS)	ΔT (HRS)	AVG. INFLOW RATE (CFS)	AVG. INFLOW (AC-FT)	TRIAL RESERVOIR ELEVATION AT END OF ΔT	RATE OF OUTFLOW CFS: END OF ΔT	RATE OF OUTFLOW CFS: AVG. FOR ΔT	OUTFLOW FOR ΔT (AC-FT.)	INCREMENTAL STORAGE ΔS (AC-FT.)	TOTAL STORAGE (AC-FT.)	RESERVOIR ELEVATION AT END OF ΔT.	
0											
	1	465	40	~~163.5~~	~~338~~	~~169~~	~~14~~	~~26~~	~~26~~	~~163.56~~	
1				163.56	367	184	15	25	25	163.55	
	1	1395	116	~~164.30~~	~~856~~	~~612~~	~~51~~	~~65~~	~~90~~	~~164.20~~	
2				164.20	769	568	47	69	94	164.23	
	1	2325	194	165.00	1578	1173	98	96	190	165.00	
3											
	1	3255	271	~~166.00~~	~~2918~~	~~2296~~	~~191~~	~~80~~	~~270~~	~~165.66~~	
4				165.78	2606	2092	174	97	287	165.79	
	1	3700	308	166.30	3384	2995	250	58	345	166.30	
5											
	1	3335	278	166.30	3384	3384	282	-4	341	166.30	MAX
6											
	1	2780	232	166.00	2918	3151	263	-31	310	166.00	
7											
	1	2225	185	~~165.50~~	~~2210~~	~~2564~~	~~214~~	~~-29~~	~~281~~	~~165.75~~	
8				165.70	2483	2700	225	-40	270	165.68	
	1	1670	139	~~165.40~~	~~2084~~	~~2284~~	~~190~~	~~-51~~	~~219~~	~~165.25~~	
9				165.30	1957	2220	185	-46	224	165.31	
	1	1110	93	~~165.00~~	~~1578~~	~~1747~~	~~147~~	~~-54~~	~~170~~	~~164.88~~	
10				164.90	1469	1713	143	-50	174	164.90	
	1	555	46	164.50	1033	1251	104	-58	116	164.50	
11											

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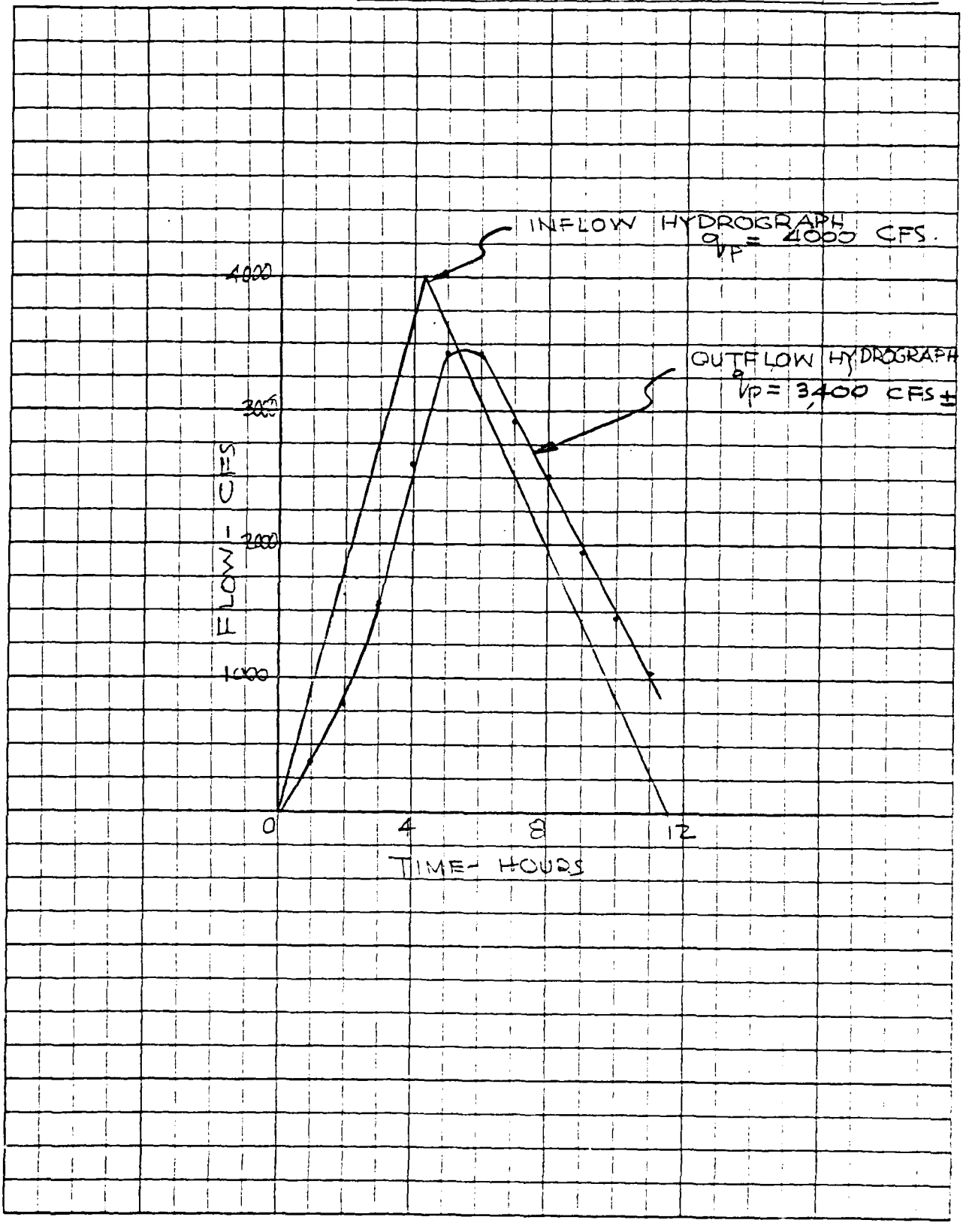
Job BUGBEE DAM
Sheet Number D-9
Date 5.5.1981
By R.S.

INFLOW & OUTFLOW HYDROGRAPHS



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Job BUGBEE RESERVOIR DAM
Sheet Number D-10
Date 2·25·1981
By R.S.

DAM FAILURE FLOOD ROUTING

STORAGE CAPACITY UPTO TEST FLOOD ELEVATION OF 165.4 = 970 AC·FT.

AS PER CORPS OF ENGINEERS GUIDELINES:

$$Q_{P_1} = \frac{8}{27} \cdot W_b \cdot \sqrt{g} \cdot y_o^{3/2}$$

WHERE Q_{P_1} = DAM FAILURE PEAK OUTFLOW IN C.F.S.

W_b = BREACH WIDTH = 40% OF DAM LENGTH AT MID-HEIGHT.

Y_o = HEIGHT FROM STREAM-BED TO POOL LEVEL AT FAILURE

SUBSTITUTING THE VALUES OF W_b AND Y_o AS $(0.4 \times 410')$ AND 17.5 FT. RESPECTIVELY:

$$Q_{P_1} = \frac{8}{27} \times (0.4 \times 410) \times \sqrt{32.2} \times 18.5^{3/2}$$

$$= 20{,}000 \text{ CFS} \pm$$

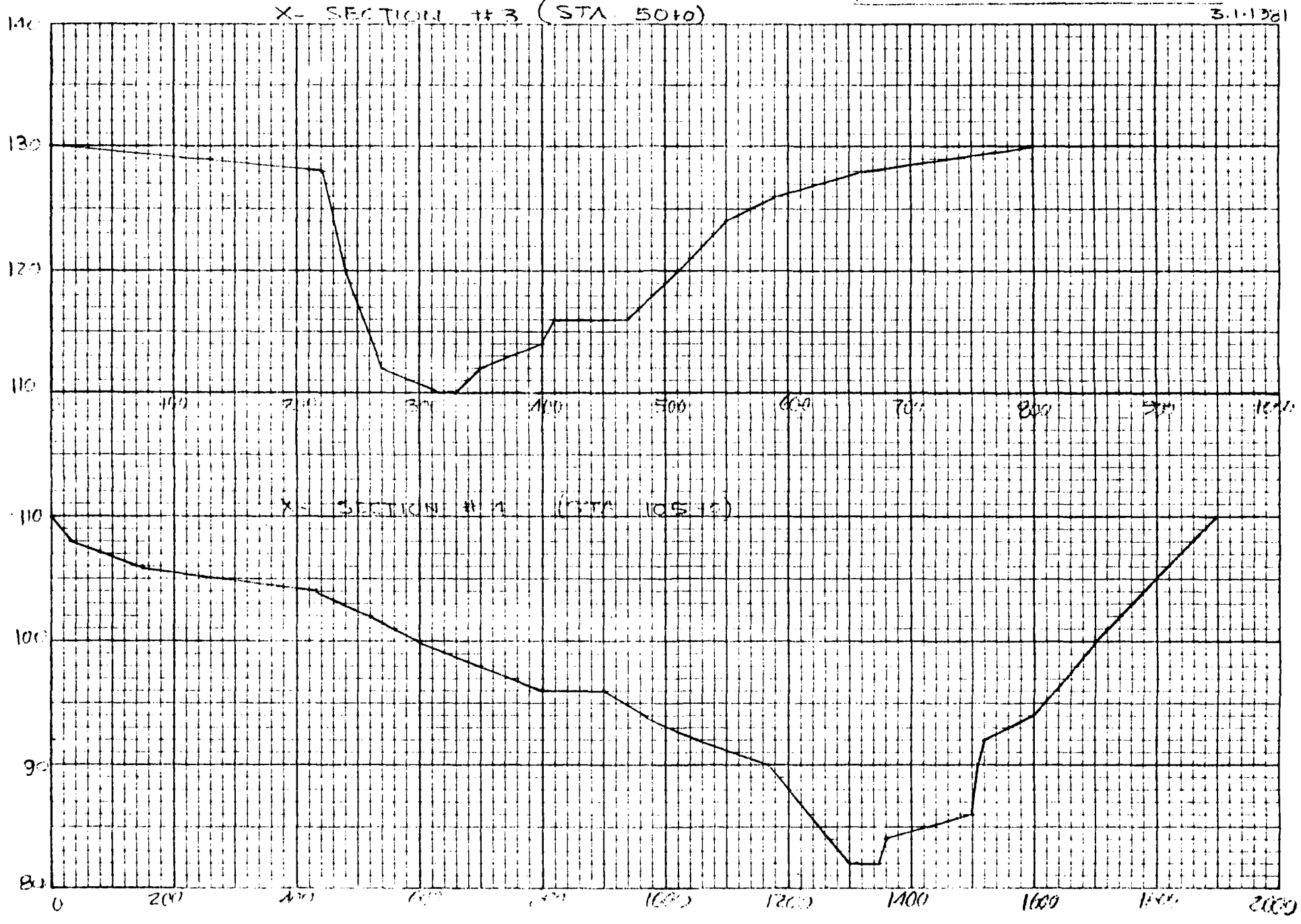
BUGBEE RES. DAM 3.1.1981

SHEET # A-11

NO 340A 10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO
MADE IN U. S. A.

BUGBEE RESERVOIR DAM



SHEET # V-14

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Job BUGBEE RESERVOIR DAM
Sheet Number D-13
Date 3.1.1981
By R.S.

X-SEC. #1 STA. 5+0.

ELEV.	D (FT.)	P_W (FT)	A (S.F)	R (= A/P_W) FT.	S FT/FT.	V (= $1.486/n \, R^{2/3} S^{1/2}$)	Q CFS
145.0	3.0	140	160	1.14		3.80	610
150.0	8.0	230	985	4.28		9.17	9030
					.0067		
155.0	13.0	400	2400	6.00		11.49	27580
160.0	18.0	510	4675	9.17		15.24	71250

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Job BUGBEE RESERVOIR DAM
Sheet Number D-14
Date 3.1.1981
By R.S.

X- SECTION #2 STA. 25+0

ELEV.	D (FT.)	P_W (FT.)	A (S.F.)	$R = A/P_W$	S (FT./FT.)	$V = \frac{1.486}{n} R^{2/3} S^{1/2}$ (FT./SEC.)	Q CFS.
127.0	3.0	90	100	1.11		4.07	407
130.0	6.0	190	570	3.00		7.90	4,500
135.0	11.0	470	2000	4.26	0.008	10.00	20,000
140.0	16.0	810	5200	6.42		13.13	68,280
146.0	22.0	1020	10,600	10.39		18.10	191,860

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Job BUGBEE RESERVOIR DAM
Sheet Number D-15
Date 3-1-1981
By RS

X- SECTION #3 (STA. 50+0)

ELEV.	D. (FT)	P_w (FT)	A. (S.F.)	$R = (A/P_w)$ (FT)	S (FT/FT)	$V = \frac{1.486}{n} R^{2/3} S^{1/2}$ (FT./SEC)	Q CFS
113.0	3.0	100	200	2.0		4.3	860
115.0	5.0	145	450	3.10		5.7	2570
120.0	10.0	270	1550	5.74	0.004	8.59	13310
125.0	15.0	340	3075	9.04		11.64	35800
130.0	20.0	800	5460	6.83		9.66	52740

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Job BUGBEE RESERVOIR DAM
Sheet Number D-16
Date 3.7.81
By R.S.

DAM FAILURE FLOOD ROUTING

X- SECTION #1 - (STA. 5+0)

FOR Q_{P_1} = 20,000 CFS. $H_1 = 11.0'$ AND $A_1 = 1,834$ S.F.

REACH LENGTH = 500 FT

STORAGE VOLUME = 500 x 1834 / 43560 = 21.0 AC FT.

$Q_{P_2} = Q_{P_1}\left(1 - \frac{21}{970}\right)$ = 20,000 x 0.978 = 19,750 CFS

$H_2 = 10.9'$ AND $A_2 = 1806$ S.F.

STORAGE = 500 x 1806 / 43560 = 20.8 AC. FT. (AVG = 20.9')

$Q_{P_3} = Q_{P_1}\left(1 - \frac{20.9}{970}\right)$ = 20,000 x 0.978 = 19,750 CFS

THE ROUTED FLOW BELOW X- SEC. #1 WILL BE 19,750 CFS AND $H = 11.0'$

POST. FAILURE FLOOD ELEVATION = 142.0 + 11.0
= 153.0

PRE-FAILURE FLOW = 3,400 CFS
FLOW DEPTH = 4.7'

AND FLOOD ELEVATION = 142.0 + 4.7' = 146.7
SAY 147.0

RISE IN FLOOD STAGE = 153.0 - 147.0
= 6.0'

NUMBER OF HOUSES FLOODED:

BEFORE FAILURE = 0

AFTER FAILURE = 1

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Job BUGBEE RESERVOIR DAM
Sheet Number D-17
Date 3.7.81
By R.S.

DAM FAILURE FLOOD ROUTING

X-SECTION #2 (STA. 2540)

FOR Q_{p_1} = 19750 CFS, H_1 = 10.9' AND A_1 = 1977 S.F.
REACH LENGTH = 2000 FT.
STORAGE = 2000 × 1977 / 43560 = 90.8 AC-FT

$Q_{p2} = Q_{p_1}\left(1 - \frac{90.8}{970}\right) = 19750 \times 0.91 = 18000$ CFS
H_2 = 10.35' AND A_2 = 1815 S.F.
STORAGE = 2000 × 1815 / 43560 = 83.3 AC-FT.
AVERAGE STORAGE = ½ (83.3 + 90.8) = 87.0 AC-FT
$Q_{p3} = Q_{p_1}\left(1 - \frac{87.0}{970}\right) = 19750 \times 0.91 = 18000$ CFS

THE ROUTED FLOW BELOW X-SECTION #2 WILL BE 18000 CFS
AND H = 10.35'

POST-FAILURE FLOOD ELEVATION = 124.0 + 10.35
= 134.35

PRE-FAILURE FLOW = 3,400 CFS
FLOW DEPTH = 5.5'
AND FLOOD ELEVATION = 124.0 + 5.5' = 129.5

RISE IN FLOOD STAGE = 134.35 − 129.50
= 4.85'

NUMBER OF HOUSES FLOODED:
BEFORE FAILURE = 0
AFTER FAILURE = 12

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Job BUGBEE RESERVOIR DAM
Sheet Number D. 18
Date
By K.S.

DAM FAILURE FLOOD ROUTING
X-SECTION #3 (STA. 50+0)

FOR Q_{P_1} = 18,000 CFS,
H_1 = 11.04′ AND A_1 = 1870 SF
REACH LENGTH = 2500 FT.
STORAGE = 2500 × 1870 / 43560 = 107 AC FT

$Q_{P_2} = Q_{P_1}\left(1 - \frac{107}{270}\right)$ = 18000 × 0.89 = 16,000 CFS.

H_2 = 10.60′ AND A_2 = 1733 SF
STORAGE = 2500 × 1733 / 43560 = 100 AC FT.
AVG. STORAGE = ½ (100 + 107) = 104 AC·FT

$Q_{P_3} = Q_{P_1}\left(1 - \frac{104}{270}\right)$ = 18000 × 0.89 = 16000 CFS

THE ROUTED FLOW BELOW X-SECTION #3
WILL BE = 16000 CFS.
AND H = 10.6′

POST-FAILURE FLOOD ELEVATION = 110.0 + 10.6
= 120.6
SAY 120.5

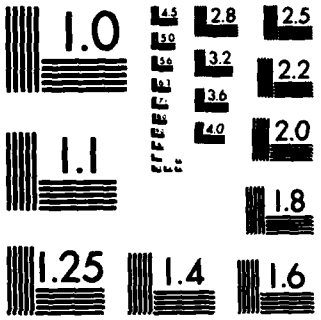
PRE-FAILURE FLOW = 3,400 CFS
FLOW-DEPTH = 5.5′
AND FLOOD-ELEVATION = 110.0 + 5.5′ = 115.5

RISE IN FLOOD STAGE = 120.5 − 115.5 = 5.0′

NUMBER OF HOUSES FLOODED:
BEFORE FAILURE = 0
AFTER FAILURE = 15

AD-A144 625 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 2/2
BUGBEE RESERVOIR DAM (.. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV JUN 81

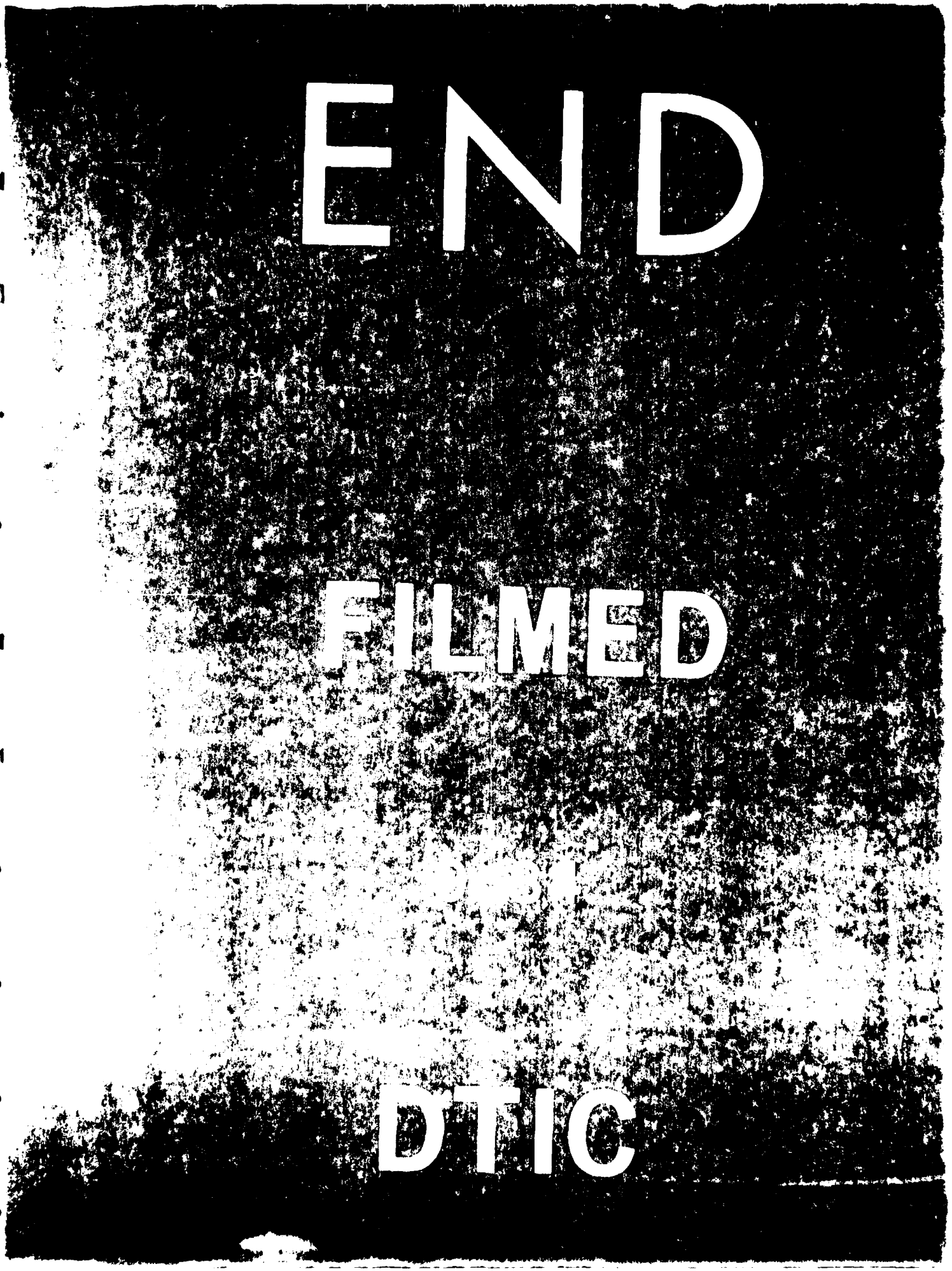
UNCLASSIFIED F/G 13/13 NL



APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

NOT AVAILABLE AT THIS TIME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